DOCUMENT RESUME

ED 326 172 HE 024 078

TITLE	Economic Competitiveness and International Knowledge: A Special Policy Briefing for Massachusetts Legislators.
INSTITUTION	New England Board of Higher Education, Boston, MA.
SPONS AGENCY	AT&T Communications, Inc., New York, NY.
PUB DATE	Jun 89
NOTE	101p.; For related documents, see HE 024 076-081.
PUB TYPE	Reports - Descriptive (141) -- Information Analyses (070)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*College Role; Economic Change; *Economic Development; Economic Impact; *Educational Cooperation; Educational Needs; Financial Support; Global Approach; Higher Education; *International Trade; Regional Programs; Research and Development; School Business Relationship; Technology Transfer
IDENTIFIERS	*Massachusetts; *New England

ABSTRACT

A policy briefing report discusses the initiatives currently in place in Massachusetts that are designed to enhance that state's economic and educational effectiveness in order to improve its international competitive position. The report is divided into four major areas of discussion: (1) an overview of the global economic challenge and the New England Board of Higher Education project that addresses international competitiveness; (2) Massachusetts's economy within the international context; (3) Massachusetts's programs for enhancing its international economic competitiveness; and (4) the role and development of higher education in Massachusetts in preparing the state for international economic competition. Included in the areas examined are the state's federal and regional resources, state-level strategies, international trade initiatives, educational initiatives, research and development (R&D) investment, and technology transfer and technical assistance. In addition, the concern about a lack of international awareness, what is being done about it, and recent legislative activity are discussed. Recommendations are made in education and training, stimulation of international awareness, R&D investments, technology transfer, and technical assistance. An appendix includes a list of Massachusetts Global Education Centers Programs, a description of the Workforce 2000 Council, and a trade profile for Massachusetts. (GLR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED326172

ECONOMIC COMPETITIVENESS AND INTERNATIONAL KNOWLEDGE IN MASSACHUSETTS

Special Policy Briefing for Massachusetts Legislators

NEW ENGLAND BOARD OF HIGHER EDUCATION
Regional Project on the Global Economy
and Higher Education in New England

HE 024 078

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
New England Board of
Higher Education
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Connecticut • Maine • Massachusetts • New Hampshire • Rhode Island • Vermont

REGIONAL PROJECT ON THE GLOBAL ECONOMY AND HIGHER EDUCATION IN NEW ENGLAND

ECONOMIC COMPETITIVENESS AND INTERNATIONAL KNOWLEDGE

A Special Policy Briefing
for
Massachusetts Legislators

June 1989

Prepared
by
The New England Board of Higher Education
45 Temple Place
Boston, Massachusetts
(617)357-9620

© Copyright by the New England Board of Higher Education 1989
All Rights Reserved

ACKNOWLEDGEMENTS

The New England Board of Higher Education _Regional Project on the Global Economy and Higher Education in New England_, including the Massachusetts perspective, which follows, has had the benefit of more than two years of staff research prior to the commencement of a series of legislative briefings in each New England state. The Board is grateful to AT&T for partially underwriting this regional project in behalf of state legislators throughout the region. In many respects, AT&T exemplifies the knowledge-based, globally oriented frontier of worldwide telelcommunications which will shape international economic, political and cultural affairs as we approach the 21st century.

PROJECT STAFF

John C. Hoy, President, New England Board of Higher Education
Judith Beachler, Director of Research, NEBHE
Sven Groennings, NEBHE Senior Fellow
Richard D. King, NEBHE Senior Fellow

This analysis for the state of Massachusetts has been prepared by:

Judith A. Beachler
Director of Research, NEBHE: Data and Policy Analyst

John O. Harney
Assistant to the President for Communication, NEBHE: Editor

To order additional copies of this report, please send a check for $10.00 payable to the New England Board of Higher Education: New England Board of Higher Education, 45 Temple Place, Boston, Massachusetts 02111.

Second Printing, September 1989

About NEBHE and the Regional Project on the Global Economy and Higher Education in New England

NEBHE was created in 1955 by an interstate compact initiated by the governors of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont, approved by the state legislatures and ratified by the U.S. Congress.

Each of the six New England states is represented on the NEBHE Board of Directors by eight delegates who are appointed by the respective state governors and legislative leaders.

Basic funding to support NEBHE programs is provided by the six New England states which make annual assessments according to a regional population formula. NEBHE seeks supplemental funding from foundations, corporations and individuals. NEBHE is a private, nonprofit educational organization granted 501(c)(3) status by the U.S. Internal Revenue Service.

The legislation which created the New England Board of Higher Education directs NEBHE to:

- Increase educational opportunities and services in New England
- Promote regional coordination and efficient use of educational resources among the six state governments and New England's public and independent higher-education institutions
- Analyze and publish regional information related to higher education
- Sponsor policy studies and forums on higher-education issues
- Explore and strengthen the connection between higher education and economic development in New England.

The planning phase of the Regional Project on the Global Economy and Higher Education in New England has received the support of concerned private-sector organizations, including: AT&T, Bank of Boston, Bank of New England, The Boston Company, Boston Globe, The Henley Group, and Peat Marwick Main & Co. Additional corporations will be asked to participate.

From the inception of the planning phase of the Regional Project, the Caucus of New England State Legislatures has provided support to several aspects of the program. The Caucus is the six-state association of House speakers, Senate presidents and majority and minority leaders of both houses.

Massachusetts EXPORT 90's

On September 15, 1989, Governor Michael S. Dukakis will have reported on the Massachusetts Export 90's initiative.

As the Governor has consistently pointed out, internationalization of the regional and state economy is now a reality and the opportunities for further global development are vast. In his view, Export 90's will help bring focus to the Commonwealth's leadership position in the decade ahead:

> "Recognition of these opportunities initiated an examination of Massachusetts companies and an assessment of their ability to compete in foreign markets. Although Massachusetts ranks 9th among the 50 states in terms of dollar amount of goods exported annually, 50% of our exports are generated by just three companies. In fact, two-thirds of the state's manufacturers receive no revenue from exports. Massachusetts can and should do better in gaining a larger share of the export market.
>
> Export 90's is designed to broaden our export base and encourage more companies to look for foreign buyers. An Export 90's Advisory Council, made up of business, government and academic leaders, was established to develop a set of recommendations to help the Commonwealth's small and medium-sized business community achieve its full export potential."

For New England and Massachusetts to "do better," intensive educational efforts will be required. The resources of our colleges and universities are at hand and a remarkable range of responsive programs exists while more are being created. To be successful, business, government and education must address the need for new knowledge and new skills in generating the level of international "savvy" our competitors in many instances already possess.

The Regional Project on the Global Economy and Higher Education in New England has been developed by the New England Board of Higher Education in order to provide a context and an assessment of the challenge which internationalization poses for the region's institutions of higher education.

PREFACE

The Regional Project on the Global Economy and Higher Education in New England

by

John C. Hoy, President

New England Board of Higher Education

The call for "international economic competitiveness" has produced some of the most overworked rhetoric of the 1980s. Still, the problem is real for all New Englanders. At stake are jobs, income, economic growth and standard of living.

New England's response to the global economy must involve collaboration among government, business and higher education. These sectors must recognize a key premise: economic competitiveness requires educational effectiveness. As our products become more technological and our markets become more global, the need for literacy and basic skills increases. New England's workforce must have math and computer skills, as well as technological and international knowledge, at least equal to that of our major competitors.

NEW ECONOMIC REALITIES

In the past two decades, the United States has experienced a decline in productivity growth; periodic national and regional recessions; massive federal budget deficits and international trade deficits; and a decline in its share of worldwide gross national product.

New England, with its pre-eminence in technological innovation, has fared better than the nation as a whole over the past decade -- and economists in the United States and abroad have cited the region as a model of the nation's capacity to reindustrialize. However, New England's economy is no longer in the vibrant phases of growth. In addition, the U.S. trade deficit is an urgent problem for New England, as it is for the entire nation.

An estimated 80 percent of all U.S. goods now face international competition either at home or abroad. New England will sustain its recent success only by capitalizing on world markets -- many of which are just beginning to grow as U.S. markets mature.

Students, workers and consumers today have an economic imperative to become internationally aware. The export of innovative technological products and advanced professional services are among New England's and the nation's greatest growth fields. Yet, in 1986, exports represented only 5 percent of U.S. GNP, compared with 27 percent in West Germany, 24 percent in Canada, and 11 percent in Japan. Leaders of economic development agencies and trade associations in New England say a lack of international cultural awareness is a chief reason many U.S. businesses have not begun exporting.

EDUCATIONAL EFFECTIVENESS

New England's economic future depends on international savvy and global effectiveness. This know-how rests, in turn, on the effectiveness of higher education, and indeed, education at all levels. Broadly speaking, New England's 270 colleges and universities play two crucial roles in this regard. They offer the promise of generating a competent and internationally aware citizenry. And their research stimulates the entrepreneurial activity that makes New England a significant contributor to U.S. competitiveness in international markets.

Recognizing these crucial links, the New England Board of Higher Education (NEBHE) has initiated a study of the specific roles the region's colleges and universities must play in preparing citizens to be knowledgeable consumers and vital contributors to the global economy over the long term.

NEBHE has devoted more than two years of research to the Regional Project on the Global Economy and Higher Education in New England. The project aims to: upgrade education at all levels; heighten international awareness among all citizens; coordinate the international economic initiatives of business, higher education and government; develop more timely data on international issues; and foster technology transfer and technical assistance.

KEY ISSUES

In the course of its research, NEBHE has identified certain key issues that must be addressed if New England is to succeed in the global economy:

- **Education and Training.** Global economic competition adds to our demands for a well-educated workforce. But many signs indicate we are falling behind our economic competitors in literacy and basic education. Only about 70 percent of U.S. students finish high school, compared with Japan's 98 percent. Between 20 million and 30 million U.S. adults are considered functionally illiterate.

- **International Awareness.** Economic competitiveness requires international awareness. But foreign-language study in the United States has declined over the long term, and study-abroad and overseas-internship programs are limited. While the international dimension has not been integrated into most business-school curricula, international studies in the liberal arts usually lack an economic perspective.

- **Business-Higher Education Coordination.** New England business leaders increasingly focus on international issues. But their approaches and goals are not coordinated with those of higher education, resulting in duplicated efforts, and depriving faculty, students and businesses of the benefits they could offer one another in terms of internships, continuing education and data sharing.

- **Timely Data.** Throughout America, state and regional policymaking is hampered by a lack of timely U.S. data on state-by-state trade, as well as comparative information on educational achievement and other socio-economic characteristics pertinent to competitiveness. Little is known about the import side of the manufacturing trade equation at the state level, and even less is known about international aspects of the service sector. Students, teachers and corporate and government leaders have no central source to turn to for an overview.

- **Technology Transfer.** New England's research prowess is a major competitive asset. Transferring research-spawned knowledge to the world marketplace will be crucial to the nation's trade future and the careers of today's undergraduates. But technology transfer has not been adequate to transform research into economic gain. Students, businesses and policymakers do not have an effective network to help them apply new knowledge on a timely basis.

PROJECT COMPONENTS

The NEBHE Regional Project on the Global Economy and Higher Education in New England was established in early 1987. NEBHE research has focused primarily on what New England campuses are doing now and what they may do in the future to heighten international awareness and enhance the region's international competitiveness. A key consideration throughout this analysis has been how New England colleges and universities may share resources among themselves -- and with businesses, government and local school districts -- to meet the new challenges posed by global economic change.

To date, NEBHE has completed the following tasks in connection with the Regional Project:

The Future of New England Survey. In the spring of 1987, NEBHE's six-state Future of New England Survey asked New England governors, legislators, business executives, college presidents and governing board members to evaluate the effectiveness of colleges and universities in preparing the workforce for a global economy and suggest specific ways that educational effectiveness could be enhanced.

Only 32 percent of the business leaders said they believed colleges and universities were effective. Leaders ranked "design an undergraduate curriculum that ensures understanding of a global economy" as the most important step for colleges and universities in preparing New England's workforce for the global economy.

Case Study: International Initiatives at New England Campuses. NEBHE has conducted personal interviews with more than 200 internationally oriented scholars and administrators at 40 representative institutions of higher education (public and independent, two-year and four-year) throughout the region to evaluate campus initiatives for dealing with the increasingly global economy. This assessment is being expanded and updated in conjunction with legislative briefings in each New England state.

Case Study: Corporate Perspectives on International Knowledge and Economic Competitiveness. NEBHE has conducted personal interviews with approximately 50 corporate leaders and state trade office leaders to gain an indepth view of the business world's perspective on higher education's role in an international economy. This assessment also is being expanded in conjunction with legislative briefings. The following major themes have emerged:

- Because of a historical focus on domestic markets, the United States is adjusting too slowly to new global economic realties.
- If the United States is to increase export activity, businesses must have a broader base of international knowledge.
- Professionals who have the ability to conduct management, negotiation and marketing across cultures are increasingly valuable.

Pilot Legislative Briefings. NEBHE has begun a pilot round of briefings for legislators in each New England state. The briefings are intended to update lawmakers on the new realities of the global economy and recommend ways for higher education to collaborate with business and government to meet the new challenges. State-specific background papers have been prepared and issued in conjunction with the briefings.

Project Advisory Council. NEBHE has created a Project Advisory Council, comprised of knowledgeable individuals from the six participating states, to offer input, direction and evaluation for the project. NEBHE plans to expand membership of the Council.

This background paper is intended to shed light on the initiatives currently in place in Massachusetts, to enhance competitiveness, and offer recommendations to improve the state's competitive position.

10

TABLE OF CONTENTS

- Acknowledgements i
- About NEBHE ii
- Export 90's iii
- Preface iv

- I. Introduction: The Global Economic Challenge 1
  - The NEBHE Regional Project 2

- II. Massachusetts Economy in an International Context 3
  - Foreign Investment in Massachusetts 4
  - Manufactured Exports: Their Impact 4
    - Dollar Value of Manufactured Exports 5
    - Employment Related to Manufactured Exports 10
  - New England Trade with Canada 12
  - Potential Export Growth Among New England Small Businesses 13
  - Findings and Summary Comments 15

- III. International Economic Competitiveness: Programs in Massachusetts 16
  - Federal Trade Resources 16
    - The International Trade Administration 17
    - Small Business Administration 17
  - Regional Resources 19
    - Small Business Association of New England 19
    - Massport's Trade Development Unit 20
    - International Business Center of New England 20
    - Other Regional Programs 20
  - Fiscal Challenges Face State Government 21
  - State-Level Strategies in Massachusetts 21
    - Financial Incentives to Enhance Economic Development 22
      - State Venture Capital Funds 23
      - State Industrial Development 23
      - Privately Sponsored Development Programs 25
    - Blueprint 2000 26
    - Job Creation: Training, Worker Displacement Programs and Technical Assistance for Business 26
      - Bay State Skills Corporation 27
      - MASSJOBS 28
    - Technology Transfer Initiatives 29
      - Massachusetts Centers of Excellence Corporation (MCEC) 29
      - Massachusetts Biotechnology Research Park 30
      - Other Economic Development Initiatives 31
    - Recent Legislative Activity 31
      - Legislative Survey of Small Businesses Exporting 32
  - International Trade Initiatives 32
    - Massachusetts Office of International Trade and Investment 33
    - Export 90's 34
    - Other State Offices 35
    - International Coordinating Council 35
    - World Trade Center Boston 36

    World Affairs Councils: Boston and Springfield 36
    Massachusetts Global Education Centers 37
    A Key Program 38
    Other Resources for International Trade Promotion 39
  Findings and Summary Comments 40

IV. Higher Education and International Economic Competitiveness 42

  The Need for Higher Levels of Education and International Awareness and Expanded Levels of Research, Development and Technology Transfer

  Education in the Global Economy 44
    Literacy and Education in Massachusetts 45
    Science and Engineering Education: Generating a Knowledge-Intensive Economy ... 47
    Massachusetts Initiatives to Heighten Levels of Education 48
    Baystate Business, Government and Education Partnership 50
    Biotech Partnership 51
  Lack of International Awareness 52
    Campus-based International Initiatives 52
  Foreign Student Enrollment 57
  Business-Higher Education Lack Coordination 58
  R&D Investment 59
    Massachusetts Share of Federal R&D 60
    R&D Expenditures at Colleges and Universities 62
    National Institutes of Health Funding 64
    Summary Remarks 65
  Technology Transfer and Technical Assistance 65
    Campus-Based Technology Transfer 66
    Campus-Based Technical Assistance 68
    Massachusetts Global Education Centers 70
  Coordinating Efforts 70

V. Recommendations 72
  Education and Training 72
  International Awareness 72
  R&D Investment, Technology Transfer and Technical Assistance 74

Appendix

  MA Global Education Centers Programs
  BEST Programs
  Workforce 2000 Project
  U.S. Canada Free Trade Agreement: Trade Profile for Massachusetts

TABLES

TABLE 1: Foreign Employment in New England 1986....4
TABLE 2: Value of Top Ten Manufacturing Industries in Massachusetts 1984 and 1986....6
TABLE 3: Value of Manufactured Exports as Percent of Total Shipments 1984 and 1986....8
TABLE 4: Value of Manufacturing Industry Exports in New England & U.S., 1984 and 1986....9
TABLE 5: Employment Related to Manufactured Exports in New England & U.S. 1984 and 1986....11
TABLE 6: New England State Trade with Canada: 1986 and 1987....12
TABLE 7: Science and Engineering Degrees, New England & Massachusetts as a Percent of U.S. Total 1985....48

FIGURES

Figure 1: Employment Related to Manufactured Exports: 1986....10

13

I. THE GLOBAL ECONOMIC CHALLENGE

The loss of international economic competitiveness experienced in the United States over the past two decades has been well-documented. The facts reveal a decline in productivity growth; periodic national and regional recessions; growth of federal budget deficits as well as international trade deficits; decline in the U.S. share of worldwide gross national product; decline in nondefense research and development (R&D) expenditures as a percent of U.S. GNP; lagging test performance of U.S. students compared with those of other countries; fall in the numbers of U.S. students pursuing doctorates in science and technical fields ... the list of factors goes on.

New England has fared better than the nation as a whole over the past decade and has been known to be cited both nationally and internationally as the prime example of the nation's capacity to reindustrialize. The region has experienced advanced industrial development based upon pre-eminent scientific infrastructure and technological innovation. New England's unequaled higher-education infrastructure has been credited for its primary impact on the region's economic renewal.

Nonetheless, New England is now at a major crossroads. With an economy that is no longer in the vibrant phases of growth, how can the region sustain its recent success? More importantly, how can we meet the complex challenges of intense international economic competition?

The economies that will meet this challenge are those capable of fostering a resourceful and flexible workforce that can utilize swiftly changing advanced technologies in an efficient and effective manner. Indeed, a well-educated workforce has been New England's primary advantage, and must become even more important as the economy becomes more international.

It has become clear that state inititatives in behalf of international competitiveness are required. This is a new role for the states. The territory is not well charted.

The NEBHE Regional Project

The New England Board of Higher Education's Regional Project on the Global Economy and Higher Education was established in early 1987.

The project is based on the following underlying premises:

- Competition on a global basis is a far more complex and demanding challenge than competition at home;
- As New England's economy becomes increasingly knowledge-intensive and dependent upon emerging advanced technologies and sophisticated services, the region also becomes more dependent upon the development of skilled human capital. This is one reason that institutions of higher education will become key players in state and regional initiatives to meet global economic challenges;
- Basic skills of U.S. entry-level employees are often not as high as basic skills of entry-level employees in other developed nations. Through attention to curriculum, higher education can foster long-term strategies to help the region address this issue, and enhance our competitiveness in an international context;
- The world economy, not the domestic economy, will grow significantly over the next several decades. New England's state and regional economies must be nurtured so they are well-positioned to take advantage of available worldwide markets;
- To be competitive in the global marketplace, policymakers must understand the strengths of each state's economy in an international context, as well as in an interstate and national context.

What follows is a summary of the issues as they pertain generally to the region and more specifically to the state of Massachusetts.

II. MASSACHUSETTS ECONOMY IN AN INTERNATIONAL CONTEXT

Foreign Investment in Massachusetts

In the last year, the level of foreign investment in the United States has sparked concern. But studies by regional and national economists suggest that to date, the impact is relatively small both in New England and in the nation. What foreign investment has occurred has been beneficial to New England in the long term in that it has introduced diversity to local economies. As global trade increases, foreign investment in the United States and by U.S. companies in other nations is very likely to continue increasing.

As a percent of non-farm employment, regional employment by foreign-owned companies in Massachusetts is quite low, second only to Rhode Island (see Table 1). The influence of foreign affiliates in Massachusetts, however, is comparatively significant by other measures. In 1985, Massachusetts ranked 12th nationally (first in New England) in the total number of foreign affiliates with property, plant and equipment, and 26th in the gross book value of their property. In terms of employment by foreign affiliates per 1,000 population the Bay State ranked 20th, nationally. Only in terms of its ranking related to acres of land owned by foreign affiliates in 1985 did Massachusetts rank in the bottom half, nationally, at 43rd.

TABLE 1
Foreign Employment in New England: 1986
(numbers in thousands)

	Non-farm Employment* (1)	Employment in Foreign Companies+ (2)	Percent in Foreign-Owned Companies**
CT	1,267.0	50.7	4.0%
ME	367.0	21.7	5.9%
MA	2,390.0	76.7	3.2%
NH	399.0	16.7	4.2%
RI	359.0	11.2	3.1%
VT	185.0	7.0	3.8%
NE	4,965.0	184.1	3.7%

*The government and financial sectors were removed from total non-farm employment for compatability purposes with non-bank company affiliates data.

+U.S. Department of Commerce data for non-bank foreign company affiliates

**Figures in Column (2) as percent of those in Column (1)

Note: Figures may not add up to totals due to rounding

Source: Wentrup, Hans J., "Foreign Ownership Has Only Mild Impact," New England Business, December 1988; and U.S. Department of Commerce, Statistical Abstract of the United States, 1988.

Manufactured Exports: Their Impact

The United States experienced flat growth in exports from 1981 through 1986, while imports grew at approximately 7.5 percent per year. The nation saw modest improvement in exports, beginning in early 1987. By mid-1987, American exports were surging and continued to do so throughout 1988. Although continued strength in imports has prevented significant improvement to the trade balance, the U.S. trade deficit by September 1988, shrank to its lowest level in three years. By the end of the first quarter of 1989, the deficit was cut by almost 10 percent.

The current export boom has been attributed, in part, to a weakened U.S. dollar, yet many economists note other important factors, such as:

- Continued vitality in service exports (the trade balance for the service sector was in the black even when overall deficits were at record highs, but projections for 1988 suggest the service sector has lost strength);
- A new emphasis by the nation's exporters on making quality products and developing leading-edge technology;
- The return home of some manufacturing across the United States that had been shifted to nations with lower labor costs;
- The relative strength of foreign economies, particularly Japan's and Europe's, that are able to absorb U.S. exports both now and in the forseeable future.

Still, exporting has not come naturally to U.S. companies. In 1987, exports represented only 5.4 percent of U.S. GNP, compared with 26 percent of West Germany's GNP, 25 percent of Canada's, and 10.5 percent of Japan's.

The United States has long been considered the world's richest market. As a result, U.S. businesses have established a narrow frame of reference that generally ends at the Atlantic and Pacific oceans; U.S. businesses are relatively ignorant of foreign cultures, languages and markets. The global economy demands that we heighten our international awareness.

Dollar Value of Manufactured Exports

New England's manufactured exports totaled $20.9 billion in 1986, 15.5 percent more than in 1984. The region's largest exporting industries included non-electrical machinery, electronics, transportation equipment, scientific instruments and fabricated metals. These five industries accounted for approximately 71 percent of the value of the region's manufactured exports.

Exports of non-electrical machinery, the region's largest industry, totaled $5.5 billion in 1986, almost 20 percent above the 1984 level. Twelve percent of the dollar value of the nation's total exports by this industry were made in New England.

The region's exports of electronic equipment were valued at $4.1 billion in 1986, approximately 32 percent above the 1984 level. This industry accounted for 9.6 percent of the electronics industry's total dollar exports nationwide.

Scientific instruments exported from New England ranked fourth in terms of total dollar value in 1986. However, the value of New England's scientific instrument exports represents almost 15 percent of the value of _all_ scientific instruments exported from the United States.

Massachusetts' five leading exports in dollar value were: non-electrical machinery, electronics, scientific instruments, transportation equipment and rubber products (see Table 2 below).

TABLE 2
Value of Top 10 Manufacturing Industries in Massachusetts: 1984 and 1986
(in millions of dollars)

INDUSTRY	1986 VALUE	1984 VALUE
NON-ELECTRICAL MACHINERY	3,208.6	3,009.7
ELECTRIC AND ELECTRONIC EQUIPMENT	2,028.7	1,447.0
SCIENTIFIC INSTRUMENTS & RELATED PRODUCTS	860.8	827.3
TRANSPORTATION EQUIPMENT	589.3	664.0
RUBBER AND MISC. PLASTIC PRODUCTS	512.8	498.1
FABRICATED METAL PRODUCTS	481.4	519.4
PRIMARY METAL INDUSTRIES	416.0	330.9
CHEMICALS AND ALLIED PRODUCTS	385.4	396.4
PAPER AND ALLIED PRODUCTS	270.4	245.8
PRINTING AND PUBLISHING	191.0	147.3

*Industries are listed in highest to lowest in order of the 1986 dollar value.

Source: U.S. Bureau of the Census, _Annual Survey of Manufactures, Origin of Exports of Manufactured Products_, 1984 and 1986, Table 5a.

In real dollars, non-electrical machinery is Massachusetts' largest export industry. This industry also ranks first in terms of what share of total production was exported. Almost 29 percent of the value of Massachusetts non-electrical machinery is accounted for by export trade. By this latter measure, primary metals, electronics, rubber products and scientific instruments rank second through fifth. Exports accounted for more than 23 percent of the value of primary metals, almost 21 percent of the value of electronics, almost 18 percent of the value of rubber products and more than 17 percent of scientific instruments (see Table 3).

The value of Bay State electronics exports grew at an impressive rate between 1984 and 1986. While the value of all U.S. exports grew by 9.7 percent and that of all Massachusetts exports by 10.9 percent, the value of Massachusetts' electronics exports grew by 40.2 percent. Among the top 10 export industries in the Bay State, only fabricated metals and chemical products posted value declines between 1984 and 1986, of 7.3 and 2.8 percent, respectively.

TABLE 3

The Value of Manufactured Exports as a Percent of Total Shipments by Industry Massachusetts & the U.S.: 1984 and 1986

Industry+	1986		1984	
	MA	U.S.	MA	U.S.
Non-Electrical Machinery	28.6	22.8	26.1	21.5
Primary Metals	23.3	23.3	19.4	19.5
Electronics	20.5	21.3	17.3	18.2
Rubber & Misc. Plastic Products	17.8	13.0	17.3	11.7
Scientific Instruments	17.4	16.5	18.1	15.4
Stone, Clay and Glass Products	16.8	7.3	14.4	7.2
Chemical and Allied Products	14.7	17.4	16.2	16.6
Fabricated Metals	13.6	12.9	13.1	11.6
Transportation Equipment	12.5	13.6	14.6	12.8
Textile Mill Products	10.9	8.2	8.2	7.4
Misc. Manufacturing Products	10.3	8.2	10.2	7.4
Paper & Allied Products	10.0	12.0	8.8	10.6
Leather & Leather Products	9.1	8.8	6.7	6.8
Petroleum & Coal Products	5.3	9.1	3.0	7.8
Printing & Publishing	4.2	4.3	4.0	4.2
Food & Kindred Products	3.1	5.0	2.2	4.8
Apparel & Other Textile Products	2.7	3.6	1.6	3.0
Furniture & Fixtures	2.6	2.8	4.0	2.7
Tobacco Products	0.0	12.1	0.0	14.6
Lumber & Wood Products	0.0	8.8	0.0	8.3
All Industries	15.9	13.0	15.0	11.9

+ Industries are listed in order of size (exports as percentage of total industry) in Massachusetts.

Note: Includes employment in the manufacture of goods that become components of other goods that are exported.

Source: U.S. Bureau of the Census, Annual Survey of Manufactures, *Origin of Exports of Manufactured Products*, 1984 and 1986, Tables 4a and 5a.

Almost 47 percent of New England's exported manufactured goods and 3 percent of the nation's are made in Massachusetts. In 1986, almost 16 percent of all Massachusetts' products were exported to foreign nations. That is slightly less than the New England average but greater than the U.S. average (see Table 4 below).

TABLE 4

VALUE OF MANUFACTURING INDUSTRIES EXPORTS IN NEW ENGLAND AND THE U.S.: 1984 and 1986

	1984				1986			
	Value of Exports ($'s in millions)	Exports as % of Total Shipments	Share of N.E. Exports (in %)	Share of U.S. Exports (in %)	Value of Exports ($'s in millions)	Exports as % of Total Shipments	Share of N.E. Exports (in %)	Share of U.S. Exports (in %)
CT	5,435.5	15.6	30.0	2.0	6,186.0	17.2	29.6	2.1
ME	1,215.0	12.2	6.7	.5	1,393.0	13.8	6.7	.5
MA	8,767.6	15.0	46.4	3.3	9,724.7	15.9	46.6	3.3
NH	1,126.8	12.9	6.2	.4	1,661.7	17.6	8.0	.6
RI	946.4	11.1	5.2	.4	1,068.9	12.7	5.1	.4
VT	617.2	16.2	3.4	.2	833.9	20.1	4.0	.3
NE	18,110.5	14.5	100.0	6.8	20,868.2	16.2	100.0	7.1
US	268,278.0	11.9		100.0	294,339.5	13.0		

Note: Figures may not add up due to rounding.

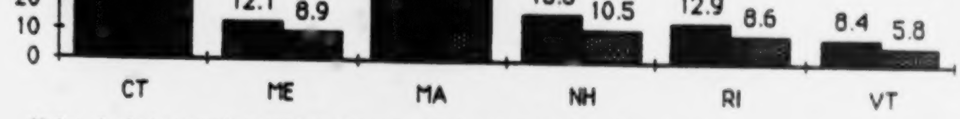
Source: U.S. Bureau of the Census, Annual Survey of Manufactures, Origin of Exports of Manufactured Products, 1984 and 1986, Tables 4a and 5a.

Employment Related to Manufactured Exports

Throughout New England, export-related industries accounted for more than 350,900 jobs in 1986, 12.5 percent more than in 1984. Approximately 208,600 of these jobs were in manufacturing industries, which directly produced the exports, while 142,300 were export-related jobs in industries including transportation, communications, agriculture and business services (these same industries also export directly). Although New England is home to only 5 percent of the nation's population, it accounts for almost 8 percent of U.S. export-related employment. In addition, New Englanders hold 9 percent of all U.S. export-related manufacturing jobs (see Figure 1). Four of the six New England states rank among the top 10 nationally in export-related employment as a percent of total civilian employment.

FIGURE 1

Employment Related to Manufactured Exports: 1986



Note: Includes employment in the manufacture of goods and services that are components of other goods that are exported.

Source: U.S. Bureau of the Census, Annual Survey of Manufactures, Origin of Exports of Manufactured Products, 1986, Table 2a.

In 1986, approximately 160,900 Massachusetts jobs were related to manufactured exports, and the state ranked second only to Connecticut, nationally in export-related manufacturing employment as a percent of total civilian employment. This 1986 ranking was a gain from 11th and third in this capacity in 1980 and 1984, respectively (see Table 5 below). Massachusetts industries in 1986 accounted for almost 46 percent of New England's export employment; New England industries accounted for almost 8 percent of the nation's.

TABLE 5

Employment Related to Manufactured Exports in New England and the United States: 1980, 1984 and 1986

	Export-Related Employment*								
	In Thousands			As Percent of Total Civilian Employment			Rank Among 50 States in Order of Size of+		
Area	1980	1984	1986	1980	1984	1986	1980	1984	1986
Connecticut	105.8	96.9	107.3	6.7	6.0	6.5	1	1	1
Maine	19.5	18.8	21.0	4.2	3.6	4.0	28	22	22
Massachusetts	151.4	144.9	160.9	5.5	5.0	5.5	11	3	2
New Hampshire	23.0	21.6	26.0	5.4	4.5	5.2	13	8	7
Rhode Island	25.4	19.1	21.5	5.9	4.3	4.5	5	11	13
Vermont	11.2	11.1	14.2	4.7	4.4	5.1	20	9	8
New England	336.3	312.6	350.9	5.5	5.0	5.5			
United States	4,808.3	4,096.7	4,576.6	4.8	3.8	4.1			

*Includes employment in the manufacture of goods and services that become components of other goods that are exported.

+Rank order is of export-related employment as percent of total civilian employment.

Source: U.S. Bureau of the Census, Annual Survey of Manufactures, Origin of Exports of Manufactured Products, 1984, Table 2a, and 1981, Table 2b.

New England Trade With Canada

State and regional policymaking is hampered by a lack of timely U.S. data on imports and exports. Although U.S. Bureau of the Census data provide descriptive information about state-level employment in export industries and the value of those industries' products, the data is old, and little is known about the current scenario. In addition, little is known about the import side of the trade equation at the state level.

The Canadian Government, however, provides data on import/export trade among all the Canadian provinces and U.S. states within four months of the close of each calendar year.

The Canadian Consulate located in Boston provided 1987 figures for the following analysis. Table 6 below shows that although 1987 exports from Massachusetts to Canada increased from 1986, Canadian exports also improved, causing a 4 percent increase in the Bay State's trade deficit with Canada.

TABLE 6

New England State Trade with Canada: 1986 and 1987
(in millions of U.S. dollars)

	1986			1987			
	Imports from Canada	Exports to Canada	Trade Balance	Imports from Canada	Exports to Canada	Trade Balance	1987 over 1986 % Increase in Exports to Canada
CT	850.4	830.7	-19.7	829.1	823.7	-5.4	-.8%
ME	766.4	256.6	-509.8	995.3	262.8	-732.5	2.4%
MA	2,358.6	1,462.8	-895.8	2,706.4	1,773.9	-932.5	21.3%
NH	310.9	128.4	-124.6	363.9	207.8	-156.1	11.5%
RI	465.0	128.4	-336.6	244.6	139.0	-105.6	8.3%
VT	802.0	190.4	-611.6	1,034.2	367.8	-666.4	93.2%
NE	5,553.3	3,055.2	-2,498.1	6,173.4	3,574.9	-2598.5	17.0%

Note: figures may not add up due to rounding

Source: Statistics Canada, "Domestic Exports/Imports to/from the United States, January to December 1987 (provided by the Canadian Consulate, Boston, MA); New England Council, "The U.S.-Canada Free Trade Agreement: A Study of the Costs and Benefits to New England," March, 1988 (used the same data for 1986 provided by the Canadian Consulate.

Total trade between Massachusetts and Canada consisted of 62 percent shipments from Canada in 1986 and 60 percent in 1987. After Connecticut, Massachusetts has the most balanced trade relationship with Canada of all the New England states. Massachusetts' total trade with Canada was higher than any other New England state, representing almost $4.5 billion in 1987.

A 1986 comprehensive trade profile for the New England states and Canada was prepared by the Northeast-Midwest Institute and published by the New England Council (see Appendix for the Massachusetts profile).

The New England Council report suggests the U.S.-Canada Free Trade Agreement will benefit New England overall, and the Massachusetts economy is expected to benefit most particularly through its computer and other electronics industries due to the removal of Canadian tarriffs.

Because the U.S. export boom started in mid-1987 and continued through 1988, the Canadian data to be released in 1989 should prove most interesting. NEBHE staff will analyze this 1988 data and incorporate it into briefing materials for legislative leaders later this year.

Important changes also are underway overseas. The integration of the Common Market economies of Western Europe into a single continental economy in 1992 could provide new advantages for American businesses selling products in Europe, if they begin preparing now. Likewise, the opening up of Eastern European economies could also provide new advantages in the years to come.

Potential Export Growth Among New England Small Businesses

Over the past 10 years, small businesses have been viewed as the generative force behind the nation's innovation and jobs. New England is unique among U.S. regions in that its economy is dominated by many small advanced-technology companies rather than large corporations. Data recently released by the U.S. Small Business Administration (SBA) show that small and medium-sized businesses make up approximately 97 percent of all businesses in both Massachusetts and in New England. It may be New England's small businesses that provide the greatest potential for growth in regional exports.

Employment in New England small businesses increased 25 percent from 1976 to 1984; and small businesses provided 50 percent of all jobs in the region from 1982 to 1986.

However, the SBA estimates that 11,000 small businesses in the nation's leading export industries have the capacity to export, but are not yet actively doing so.

Indeed, small businesses face special challenges as exporters. Companies with fewer than 20 employees often find exporting virtually impossible, in part, because they lack professional expertise in overseas markets. Obstacles include: foreign languages, time zones, taxes, regulations, international licenses and patent considerations, tariffs, customs inspection, laws, transportation and distribution systems, and varying cultural business practices.

Likewise, small businesses often lack the capital to sustain export operations through periods when the U.S. dollar's value is high relative to the currency of the importing nation. Even though small businesses have lower levels of working capital than large corporations, they incur high overhead costs when beginning an export endeavor. To make matters worse, export financing is very difficult to obtain, particularly for first-timers. Small businesses are often viewed as greater risks for financing.

Nonetheless, New England small businesses do dominate the advanced-technological industries that hold the greatest potential for export trade expansion and overall economic development. It behooves the region to nurture these companies.

Findings and Summary Comments

A review of the Massachusetts and New England economies in an international context suggests great promise, as well as certain key considerations for meeting the challenge of international economic competitiveness.

- U.S. citizens, in general, suffer from international myopia, and most lack a basic understanding of international issues.
- Although Massachusetts in 1986 was second only to Connecticut in the United States in export-related employment as a percentage of civilian employment, the degree of involvement is still small-- only 5.5 percent. Strategies must be designed to nurture industrial expansion in an international context.
- U.S. data regarding the international economic position of the states and their industries is terribly outdated at the time of its release. Steps should be taken to generate better data on a more timely basis to aid state and regional policymakers in developing the international dimensions of their economies.
- At the regional and state levels, a large number of small businesses are a dominant economic force, and these small businesses have certain competitive features that make them well-suited for international trade. But many of these small companies have not begun exporting. They may depend on other organizations for counseling, training, data analysis and market research, financial assistance, opportunities to attend trade shows and other services. A wide variety of such services exist. But the higher-education community, government and trade-related organizations must work together to further strengthen these businesses as they approach the international arena.

III. International Economic Competitiveness: Programs in Massachusetts

Governments, businesses, trade associations and higher education have designed national, regional, state and local initiatives to enhance international economic competitiveness. Although the programs vary widely, they generally aim to bolster economic development so that an overall competitive advantage can be achieved and sustained, or they specifically promote international trade.

Federal Trade Resources

On the federal level, international trade programs are sponsored by: the Agency for International Development, the departments of Agriculture, Commerce, State and Education, the Export-Import Bank, the Overseas Private Investment Corporation, the Small Business Administration, the Trade and Development Program and the Office of the U.S. Trade Representative.

A recent publication of the Small Business Administration (SBA) is a must for all state and regional organizations as well as institutions of higher education that provide international trade counseling or technical assistance. The SBA's Exporter's Guide to Federal Resources for Small Business (1988) outlines the multitude of federal programs designed to provide financial and/or technical support to U.S. companies seeking entry into or expansion in international markets. It is an excellent resource for Massachusetts' small and medium-sized companies and for those advising them on the export process.

Two federal agencies involved in international trade deserve special attention. They are the Department of Commerce's International Trade Administration and the SBA.

The International Trade Administration (ITA)

ITA, established in 1980 to promote world trade, is the official U.S. government organization coordinating all issues concerning trade development, international economic policy and programs in the area of international commerce and import administration.

Two of ITA's four offices are charged with increasing export awareness and stimulating the export of goods and services. These offices provide individual export counseling, sponsor trade missions and fairs, develop catalog and video catalog exhibitions, provide electronic information for foreign sales leads, and conduct conferences and seminars to help companies enter new markets.

Through ITA, 2,800 companies participated last year in 142 overseas trade fairs and missions, reaching almost 5 million prospective buyers, agents and distributors. Projects are generally coordinated with local offices of the SBA, state agencies and area trade associations. ITA has 48 offices in the United States, as well as posts in more than 120 foreign countries. ITA's Massachusetts office is located in Boston and also serves Maine, New Hampshire, and Vermont.

ITA's biweekly publication, Business America, is a useful tool for state and local leaders involved in international trade development as well as for current and future exporters.

Small Business Administration (SBA) Resources in Massachusetts

The SBA offers a multitude of services for the small-business person, as well as for individuals contemplating the creation of a small-business enterprise. Many SBA services are delivered locally through coordination with colleges and universities. While some SBA services are designed to assist small businesses with management in general, others are specifically geared toward providing international trade assistance, both financial and technical.

The SBA's Small Business Institutes (SBIs) offer free guidance and assistance to small businesses. The SBIs are staffed by college seniors and graduate business administration students (for academic credit) and their faculty advisors under SBA guidance. SBIs are located at Babson College, Bentley College, Boston College, American International College, North Adams State College, Western New England College, and Westfield State College and at Boston University, Clark University, Harvard University, Northeastern University, Southeastern Massachusetts University, and Suffolk University. SBI's are also located at UMass-Boston and Amherst and at the University of Lowell.

The SBA's Small Business Development Centers (SBDCs) draw upon federal, state and local government resources, as well as the private sector and universities to provide small businesses with management and technical assistance, counseling and practical training. SBDCs in Massachusetts are coordinated by UMass-Amherst's School of Management. SBDC satellite offices are also located at Boston College (Chestnut Hill/Greater Boston), Clark University (Worcester), Roxbury Community College (Boston), Southeastern Massachusetts University (Fall River), University of Lowell and UMass-Western Regional Center (Springfield).

The International Trade Counseling and Training Program is the SBA program most specifically related to international trade. Established in the 1970s, this program provides one-time free legal advice for small and medium-sized companies that are new to exporting, as well as counseling and financial assistance for managers of small businesses that are considering entering international markets or expanding current export operations. Much of this activity is managed by the SBA's Business Development staff and coordinated with the Department of Commerce's International Trade Administration.

Regional Resources

Certain regional organizations are involved in promoting international trade by New England businesses. They include the Small Business Association of New England, Massport's Trade Development Unit and the International Business Center of New England. Though these organizations are regional in scope, they are all located in the Greater Boston area, and Boston-area businesses benefit the most from their services.

Small Business Association of New England (SBANE)

SBANE, a member organization for small businesses in the region maintains an international trade committee, called SINTRAC, which meets monthly to discuss problems and issues pertinent to exporting. This committee's 36 members are drawn from small businesses that are already exporting, as well as representatives of the U. S. Department of Commerce, SBA and appropriate state offices throughout New England. SINTRAC members also include representatives of a small number of business organizations serving the international trade community.

SINTRAC projects include training programs in export administration (co-sponsored with the International Business Center of New England), and export dialogue programs involving chief executive officers who are experienced in foreign trade and willing to share their experience in marketing and distribution, and shed light on their relationships with bankers, agents, brokers and freight forwarders. In 1989, SBANE's annual New England Business Conference, for the first time, included an international trade component, with general sessions on international trade, selling products overseas, financing international business, developing international joint ventures, the U.S.-Canada Free Trade Agreement and the European Community in 1992. The international component is likely to become a permanent part of SBANE's annual meetings.

Massport's Trade Development Unit

For more than a decade, the Trade Development Unit of Massport has provided referrals, research, marketing assistance and general guidance to small and medium-sized New England manufacturers seeking to begin exporting or expand current export operations. Each year, Massport assists more than 100 businesses through market research and analysis of products and countries. Massport also sponsors trade shows, trade missions and business meetings, and provides general information on international business and export opportunities. In addition, for companies doing market research, Massport operates an international business library located at the World Trade Center in Boston. While the majority of Massport's clients are based in Massachusetts, 10 percent to 25 percent are drawn from the remaining five New England states. Massport maintains international trade offices in London and Tokyo.

International Business Center of New England

The International Business Center of New England, established in 1956, sponsors seminars and programs for businesses interested in international trade. The center coordinates its efforts with other regional organizations, as well as those serving the Greater Boston area.

Other Regional Programs

Several other regional organizations have provided policy studies and data analysis; others have coordinated workshops, seminars and meetings related to the issue of international economic competitiveness. These organizations include the New England Board of Higher Education, the New England Caucus of State Legislatures, the New England Council and the New England Governors' Conference.

Fiscal Challenges Face State Government

While the Legislature considers new initiatives, it is also confronted with major fiscal challenges. As cuts in state spending and legislation to raise additional revenue are being considered, it is critical that the Commonwealth remind itself of the economic crossroad that New England has reached. Though the state enjoys a high rate of employment and fundamental economic strength, rates of growth have declined. Nonetheless, in order to meet the challenges of international economic competitiveness, local school districts as well as colleges and universities must have the resources to prepare a highly educated, internationally aware workforce through comprehensive foreign language, science, math and computer literacy programs. As the recent MIT study, Made in America, points out, the nation's economic position worldwide has been undermined by a neglect of basic education, at a time when we need education the most. Local schools, colleges and universities must have the resources to provide the high-quality education and R&D infrastructure upon which our economy is so dependent.

State Level Strategies in Massachusetts

For almost 10 years, Massachusetts has served as the nation's exemplary case of economic revival. As many other states saw their economies decline in the 1980s, their leaders have looked to the Bay State to learn how they too might halt decline and enter a period of high growth. The revival that occurred in Massachusetts is most often attributed to the growth of high-tech industries, business services and defense contracts during a decline of more traditional manufacturing industries. Informal relationships between technical research universities and small high-tech businesses that subsequently evolved from the research efforts, created the now famous Route

34

128 industrial complex. Basic services provided by state and local governments though not generally credited for the success that occurred, were essential to preserving the economic base while private initiatives generated new jobs. Government initiatives of the late 1970s and early 1980s then nurtured the growth that was taking place. In addition, Massachusetts has been viewed as a leader in divising consensus-building efforts among citizens and public/private partnerships that have influenced economic policy over the past fifteen years.

Among these consensus-building initiatives, the Bay State's program of geographic targeting (initiated during the first Dukakis Administration) has been labeled the most ambitious state program to steer growth toward old industrial cities. Beginning in 1975, Local Growth Policy Committees in 330 of the state's 351 cities and towns involved over 5,000 citizens in the consensus-building effort to revitalize economically troubled areas. For example, the Heritage Park initiative in Lowell combined state and federal resources to rejuvenate the city's historic downtown area. Most of the state programs between 1975 and 1980 provided incentive goals to rejuvenate depressed regions of Massachusetts.

Financial Incentives to Enhance Economic Development

Massachusetts has created a wide array of public and private financial incentives for economic development. At least nine funds, corporations and agencies have been created to provide working capital, equipment financing, venture capital and product development funds. The state also maintains a toll-free corporate finance information hotline as a "one phone call" source of information on various financing programs and agencies.

State Venture Capital Funds

A 1975 public venture capital fund was one of the state's earliest economic development programs. Like the Connecticut Product Development Corporation established as the nation's first such public fund in 1973, the Massachusetts Community Development Finance Corporation, (CDFC) was created by the Legislature as a source of capital for business investment that would create jobs or other benefits for depressed areas of the state. CDFC's three investment initiatives include a venture capital program that provides debt and equity financing to viable small businesses, a Small Business Loan Guarantee Program that broadens the availability of commercial credit to small businesses, and a Community Development Corporation Program for real estate projects sponsored by locally based community development corporations acting in partnership with companies wishing to expand or locate in their communities.

Similarly, the Massachusetts Product Development Corporation (MPDC), provides financing and technical assistance to mature industries that have experienced job loss resulting from foreign competition, declining markets or shifts in industrial technologies.

Geared more specifically to high-tech industrial development, the Massachusetts Technology Development Corporation (MTDC) was established in 1978. MTDC, a quasi-public corporation, generally makes investments of up to $500,000 on a co-venture basis with private venture capital firms and other investors. New and expanding high-tech companies must be able to generate employment growth in the Bay State if they are to qualify for the program.

State Industrial Development

More traditional state funding mechanisms as well as some newer creative ones are managed by the Massachusetts Industrial Finance Agency (MIFA). MIFA issues tax-exempt industrial development bonds, approves those issued by municipal authorities, and provides both tax-exempt financing and direct loan incentives to small, growth-oriented businesses. MIFA also manages the Commercial Area Revitalization District program designed to revive older downtown areas with low-interest loans. In addition, MIFA manages guaranteed loan programs to give small businesses and downtown revitalization programs access to the public credit market.

MIFA operates a unique loan fund for child-care centers at workplaces, a mortgage insurance program and a thrift fund to fill credit gaps for worthy projects. MIFA programs provide lower-cost financing for private businesses to create jobs, revitalize the state's commercial centers and strengthen the tax base of both the state and local communities. Like most of the state's programs, those managed by MIFA are designed specifically to aid mature industries and distressed areas, while promoting small business development.

The Massachusetts Government Land Bank (MGLB) was established in 1975 as a quasi-public state agency with several goals. MGLB provides real-estate development and finance assistance at below-market mortgage rates to: industrial projects that will increase jobs in areas of high unemployment; housing projects with at least 30 percent of units for low and moderate-income families; and small-business incubators that will create jobs and stimulate entrepreneurial activity. To be eligible for assistance, developers, cities, towns or nonprofit organizations must be considering development of distressed or blighted property, show a clear need for public financing, show the projects are financially feasible, and, upon award of Land Bank funds, leverage additional financial resources.

The Thrift Fund, proposed by Gov. Dukakis and established in 1984 by an act of the Legislature, is a $100 million direct lending pool established to facilitate economic development throughout the state with the goal of job creation and retention. The Fund's resources are drawn pro rata from the state's savings banks, cooperative banks, federal savings banks and savings and loan associations. Serving as a supplement to conventional financing or other publicly supported programs, the Fund gives priority to projects that will develop small business, support mature industries, create residential and industrial development projects eligible under the federal Urban Development Action Grant Program, generate commercial development in older urban centers or build affordable housing. The Fund provides secured loans for eligible borrowers.

Privately Sponsored Development Programs

There are two notable privately funded development programs in Massachusetts. The Massachusetts Business Development Corporation (MBDC), established in 1953, is a privately owned corporation in which financial institutions of the state pool money to provide medium and long-term loans to promising firms that don't qualify for conventional sources. Eligible activities include land, building or equipment purchase or working capital for construction. Shareholder institutions supply the corporation with equity, and member institutions doing business in the state lend money to the corporation when called upon. Additional funds also are obtained through the SBA to promote mortgage financing at low cost for small businesses acquiring real property and equipment.

The Massachusetts Capitol Resource Company (MCRC) is a privately owned limited partnership funded by Massachusetts-based life insurance companies to provide high-risk capital for businesses unable to obtain funds from more conventional capital funds. When the Company began its operation in 1978, the majority of its funds went to technology-based industries. MCRC has since redirected its focus to include companies in mature industries. MCRC's goal is to assist in the maintenance and growth of Massachusetts manufacturing and industrial operations, while stimulating employment opportunities in the state. Programs include long-term loans, subordinated loans to companies that lack sufficient access to traditional markets, but need equity-type funds, growth capital to young organizations that have either outgrown initial infusions or are unable to gain access to more mature equity funds, and funds to assist other lenders or creditors in revitalizing existing businesses.

Blueprint 2000

In 1987, Lt. Gov. Evelyn F. Murphy established another statewide consensus-building process involving citizens and leaders of education, business and social and economic organizations. Members of these groups are examining and projecting state trends between 1970 and the year 2000 in an effort to form a basis for policies to enhance future quality of life in terms of environmental, sociological, economic and educational concerns. The Blueprint 2000 project's goal is to serve the Commonwealth as a long-term economic development plan. A comprehensive study, still underway, is looking specifically at jobs, export trade and the state's economy, the physical environment (pollution, transportation, energy and housing), human support (health and human services, youth, elders, and crimial justice), and education (K-12, higher education and continuing and specialized education). Project phases include assessment, policy development and recommended policy action plans.

Job Creation: Training, Worker Displacement Programs and Technical Assistance to Businesses

Massachusetts has a comprehensive array of programs designed both to ease the displacement of workers in mature industries, and to provide training opportunities to meet the needs of state residents and employers.

The Industrial Sevices Program (ISP), a statewide technical assistance program develops and coordinates re-employment programs for displaced workers. Established in 1985, ISP's Worker Assistance Centers provide job-search assistance, education/training programs, career counseling and related support services. Operating with a team of private-sector consultants, ISP also works with companies to identify efficiency problems, new markets, more productive manufacturing processes or capital needs. ISP also manages the Economic Stabilization Trust (EST) that was created through a provision of the state's Mature Industry Law in 1985. EST provides assistance to troubled but solvent firms through various forms of debt and equity financing. Though loans are of a higher risk than normally accepted by conventional lending institutions, state backing makes the investments more attractive, thus more secure for other investors. Massachusetts also has a four-year-old plant closing law that provides a package of inducements for industries to notify workers in advance of closings. They include assistance with pay and health benefits and job referral services that are then managed by ISP.

Massachusetts has created several training initiatives: a program to reimburse employers for 50 percent of employee wages lost during on-the-job training programs; JTPA programs managed by 15 locally-based Private Industry Councils in the state; and the nationally renowned Bay State Skills Corporation.

Bay State Skills Corporation (BSCC)

BSSC was created by the Legislature in 1981 as a quasi-public agency that would respond to the training needs of the new, particularly knowlege-intensive industries that have been replacing the more traditional industries in decline. Under state regulations, BSSC does not provide training, but provides grants to educational institutions that enter into partnerships with employers to train residents for specific jobs. Employers match state funds (50/50) through the provision of program funds, equipment, instructors or wages for participants during training. Training takes place in colleges, universities, schools and training centers in the state or at a company's own facility. Since 1981, BSSC has awarded $27 million that has been matched to almost 200 educational institutions. This has provided for more than 400 different programs since its inception, training more than 30,000 residents. Approximately 87 percent of all program graduates find full-time employment in private industry.

In cooperation with the state's Department of Public Welfare, BSSC also funds programs to train welfare recipients through the ET CHOICES program. The Bay State's effort in training welfare recipients was one of the first in the nation, serving as a model for several other states.

MASSJOBS

In 1988, Gov. Dukakis initiated MASSJOBS, a proposal aimed at coordinating the variety of education and training programs through the creation of a council of top business, government, labor and education leaders who oversee training and education policy for the state. Through this inititative, the Division of Employment Security was merged with the Office of Training and Employment Policy to create a single agency, the Department of Employment and Training. Private industry councils were designated as Regional Employment Boards, expanding representation from labor and community groups. Funds to expand literacy training at the workplace as well as programs for at-risk youth were allocated and a MASSJOBS West Partnership was created to link economic development and job training in Western Massachusetts.

Technology Transfer Initiatives

States across the nation have initiated policies to bridge the gap between university-based R&D and its industrial commercialization. Massachusetts has devised two major strategies to promote research from basic scientific discoveries to development that will benefit the Bay State.

Massachusetts Centers of Excellence Corporation (MCEC)

Created in 1985, MCEC's goal is to promote the development of four focus "Centers of Excellence" in emerging technologies--polymer science, biotechnology, photovoltaics and marine science, with each center representative of a collaborative effort among private industry, higher education, state government and local economic development groups. Through a competitive grant program MCEC provides support to joint business/industry research projects designed to transform research ideas into economic reality. Proposals must include matching funds from particiating partners.

The Polymer Science Center is associated with the University of Massachusetts at Amherst and investments from Monsanto, Orchard Park, and General Electric, Pittsfield. The Photovoltaics Center relies on MIT and the burgeoning phototovoltaics industry generated from MIT research as well as the University of Lowell's Productivity Center, which is developing a Model Factory of the Future to enhance productivity through automation. The Marine Sciences Center is developing from research of a broad range of disciplines (physics, chemistry, biology, geology, engineering and marine research) taking place at Woods Hole Oceanographic Institute and Marine Biology Laborotory, Southeastern Massachusetts University's marine biology, aquaculture and mariculture programs and UMass-Boston's Environmental Science and Marine Ecology Programs.

The Biotechnology Center is associated with the state's Biotechnology Research Park in Worchester. This center has been instrumental in helping the Massachusetts Biotechnology Research Institute (MBRI) become a significant source of employment growth in Central Massachusettts. MBRI has utilized MCEC funds to start a venture capital firm, Commonwealth Ventures Inc. designed to target new biotech companies in need of financial support. MBRI has also devised a science lecture and laboratory series that is set to begin in public schools in the fall of 1989. Utilizing Biotech Centers for Excellence funds, industry specialists will help teach introductory biotech sessions for both teachers and students, featuring a mobile laboratory.

In addition to the grants for collaborative research programs, other Biotech Centers of Excellence Programs include information sharing, promotion of biotech nationally and internationally, assessment activities relevant to biotech in Massachusetts and active promotion of biotech development for the Bay State.

Massachusetts Biotechnology Research Park

Located adjacent to the University of Massachusetts Medical Center, the 75-acre Massachusetts Biotechnology Research Park is owned by the Worcester Business Development Corporation, which is the city of Worcester's economic development office. Tenants gain access to faculty and research expertise of UMass Medical Center (also to its library), the Worcester Foundation for Experimental Biology and Clark University and Worcester Polytechnic Institute faculty and research expertise. The Park includes a Center for Business Resources which serves as a conference and retail space center, a Magnetic Imaging Center, two Biotech Park buildings which are home to 13 companies and research laboratories.

Other Economic Development Initiatives

Several other state initiatives have been launched in recent years including the 1987 creation of the following offices: Business Development, Science and Technology and Minority and Women's Business Development and Employment. All are offices in the Executive Office of Economic Affairs. At this same time, a Western Massachusetts Office of Economic Affairs was created, and in 1988 a Small Business Incubator Program was created through legislation. Through the incubator program, small businesses pay modest rent and share central services. Incubator programs are managed by existing community, economic/industrial and municipal nonprofit development corporations.

Massachusetts also has a wide variety of tax exemptions, credits, deductions and special treatment for businesses to expand research and development, boost export sales, purchase pollution-control equipment or capital equipment, and initiate energy/fuel conservation programs.

The city of Boston's Economic Development and Industrial Corporation (EDIC) provides a variety of services and programs, including industrial-development financing, site development, training and promotion of exports by companies of the Boston area.

Recent Legislative Activity

In 1989, both the joint committees on Education, Arts and Humanities and Commerce and Labor have considered a number of bills that could enhance the state's international economic competitiveness. Education bills under consideration include initiatives in continuing education in science for elementary teachers, workforce literacy, an adult literacy education fund, an international education commission, funding for out-of-school youth programs, dropout studies, day-care services for student parents, urban partnership grant programs, bilingual education grant programs, the High Technology Morrill Act and higher education assistance in return for public service programs. The Commerce and Labor committee is also considering a number of bills relating to employment and training, economic development, business promotion and international trade. Most specifically related to international trade is legislation providing for the establishment of: a commission to study the impact of foreign investments on the Commonwealth; state offices in Europe and Japan for promotion of international trade, tourism and foreign investment; an export finance program for small businesses which would provide pre-shipment and post-shipment loan guarantees, financial management, counseling and a limited number of direct loans; an export development program that would assist state firms in export planning and development; and economic development incentives, ranging from an export tax credit to education and training deductions.

Legislative Survey of Exporting by Small Businesses

An October 1988 survey conducted by Bannon & Co. of Sudbury, Mass. for the Joint Committee on Commerce and Labor measured the interest on the part of small and medium-sized companies in developing export markets. Findings showed that there is considerable interest, but most companies do not know how to obtain the specific information they need to proceed in implementing an effective export strategy. This survey further confirms the need for support services to enhance export trade, and serves as the foundation for the recently proposed international trade legislation (previously discussed).

International Trade Initiatives

Massachusetts has made steady progress in improving its export trade position relative to other states. Massachusetts ranked 11th among the 50 states in 1980 in employment related to manufactured exports as a percent of civilian employment. It moved to second place nationally in 1986.

The business communities of Massachusetts and particularly the Greater Boston Area, benefit significantly from the variety of regional organizations providing international trade assistance (see previous section for detail). The state itself also has launched several initiatives.

Massachusetts Office of International Trade and Investment (OITI)

OITI, an office within the Executive Office of Economic Affairs, is charged with promoting and analyzing export of Massachusetts products and foreign investment in the state. OITI provides two major kinds of services: marketing and investment programs, and trade services.

Marketing and investment programs have been established to promote products of eight sectors of the economy: biotechnology, health services, medical divisions, packaging equipment, photovoltaics, precision instruments, software and telecommunications. Through this program, OITI works with approximately 200 firms annually by way of trade shows, distributor searches and the like. Though OITI has trade representatives in India, Israel, the People's Republic of China and other Asian countries, there are no formal state trade offices in any country. Legislation is currently pending to establish offices in Asia and in Europe.

The trade services operation includes a comprehensive international trade data-base, listing facts on shipping regulations, export licenses, tariffs, foreign banks, business associates, U.S. Foreign Commercial Service Offices and U.S. Embassies and Consulates by-country. Services also include a Massachusetts export services data base and a Working Capital Guarantee Program (WCGP). Through WCGP, Massachusetts is one of three states selected for a one-year pilot program of the U.S. Export-Import Bank to assist small business exporters. OITI provides technical assistance to companies through WCGP and offers guarantees of up to 90 percent of principal for working-capital to these exporters for marketing, manufacturing and purchasing raw materials.

OITI works closely with the various trade-promotion organizations of the state, and publishes export service guides for various product sectors, as well as several export services directories. In January 1989, OITI published Export Services Guide, the first state guide to international trade promotion organizations, as part of the Governor's "Export 90's" Program.

Export 90's

In January 1989, Gov. Dukakis announced a strategy to double the state's export revenue by 1993 through an initiative know as Export 90's. The initiative is a two-part effort to get small and medium-sized companies actively thinking and learning about exporting their goods and services abroad. This public-private effort includes a series of nine regional fact-finding meetings to determine problems and obstacles which businesses face as they consider export trade and to generate policies to eliminate these obstacles.

In addition, an Advisory Council of business, education and legislative leaders across the state has been formed to set priorities across five major areas of concern, one of which is education. The Advisory Council's Education Subcommittee is looking at short- and long-term solutions to enhancing education's role in export trade promotion, focusing on foreign business language training, technical assistance in the way of market research conducted by graduate business students and creation of an export academy.

The Export 90's Advisory Council effort is led by the deputy secretary of OITI on the public side and the International Coordinating Council's executive director on the private side. Gov. Dukakis is leading the regional fact-finding missions.

Other State Offices

The Massachusetts Industrial Finance Agency (MIFA) has been designated as EXIMBANK's agent in the Bay State. MIFA manages the working capital guarantee loan program that assists companies unable to finance export goods or services on their own. Loan funds are guaranteed by EXIMBANK and used to purchase materials, products, services and loans for production of goods and services for export sale.

The state Department of Agriculture works with the U.S. Department of Agriculture and the Eastern U.S. Agriculture and Food Export Council to manage the Targeted Export Assistance program, promoting commodities and products awarded favorable decision under the 1974 Trade Act. Those that are subsequently affected negatively as a result of this targeting are also assisted. Funds are also available for international promotional programs.

International Coordinating Council (ICC)

ICC was established in 1983 as a public-private partnership to coordinate the various organizations initiating international trade programs. Through its programs, ICC represents the business community's interests and works closely with area public and private international organizations. ICC coordinates an international roundtable, bringing all interested groups together to share ideas and programs and to inform one another of their own organization's activities. ICC played a lead role in creating Boston's Export Strategy Team (see appendix for detailed brochure). The Export 90's Advisory Council is headquartered with ICC.

The World Trade Center Boston

Established in the Commonwealth Pier of Boston in 1986, the World Trade Center hosts a wide variety of events and services for businesses of New England, including trade shows, missions, conferences and the like. The International Trade Administration of the U.S. Department of Commerce as well as Massport's Trade Development Unit are located in the Center, allowing effective coordination of services. As is the case in Connecticut, Boston's World Trade Center has joined the International World Trade Centers Association, gaining access to the international Electronic Network System. This system gives members access to the trade lead information of 157 member-associations throughout the world. Center members use computer modem to access the system from their own offices, making and receiving offers to buy and sell products.

World Affairs Councils (WAC): Boston and Springfield

The WAC-Boston was founded in 1949 as a nonprofit organization dedicated to increasing public awareness of international issues. The Council sponsors a wide variety of lecture services, a Young Professionals' Forum, an Ambassadors' Council, workshops, international visitors programs and special events that address international diplomatic, economic and social concerns. WAC, Boston, also sponsors a "Suburban Series," hosting programs in Wellesley and Duxbury.

WAC-Boston is dedicated to increasing international awareness and understanding on the parts of students and teachers. It has created the Global Classroom Project, inviting members of Boston's foreign college student population into area high school and junior high school classrooms to share understanding of their native countries' cultural, political and social systems. The council also sponsors a Global Education Workshop series for educators.

The WAC-Western MA was established in Springfield in 1957 with goals and programs that are similar to the Boston groups. The Council works in cooperation with the UMass-Amherst Center for International Education and the public school-college partnership, involving five organizations. WAC also serves as the home of the Consortium for Global Education. Through this consortium, teacher training and outreach programs have been established to encourage internationalization of the K-12 curriculum throughout the four counties of Western Massachusetts. The several organizations have created an International Resource Center at the Council office, providing curriculum development and educational materials to enhance teaching of world geography, history, foreign languages, economics and culture. These programs have been made possible by legislation enacted in 1987 creating five Global Education Centers throughout Massachusetts. The Centers are discussed below.

Massachusetts Global Education Centers

In an effort to begin creating a comprehensive state policy on international education, the Legislature passed two bills in 1987, both sponsored by the Joint Committee on Commerce and Labor. The first law amended the public education statute on subjects of instruction to encourage, but not mandate international programs in languages, history, economics and other areas. In an effort to assist the public schools in improving international education, the second law established the Global Education Commission, a statewide consensus-building group to form policies affecting teacher training and curriculum content. The commission's aim is to incorporate global perspectives where possible in order to improve the overall quality of public education while heightening international awareness. Six Global Education Resource Centers were created at universities throughout the state to provide teacher training and curriculum dissemination to public school teachers. By

1989, there were five centers in operation. Centers sponsor workshops and summer institutes, provide access to multi-media curriculum and offer many other services. UMass-Amherst, Wellesley College, Framingham State College, Tufts and Clark universities and the University of Lowell were selected as the centers' university homes. The University of Lowell Center is no longer funded. Likewise, the remaining five centers have experienced a reduction in state funds, due to budget problems that have affected most state programs.

The Centers have coordinated activities effectively with the broader international education and trade communities, and this project is a model for the other five New England states. More detail on Center activity is provided in the Appendix of this paper.

A Key Program

Regional, state and local economic development groups, working with regional offices of the federal government, have designed an important program in conjunction with seven area colleges and universities, which is based on a prototype designed by the Wharton School of Business at the University of Pennsylvania and is similar to a UMass-Amherst program that has served the business communities of central and western Massachusetts for more than five years.

Known as BEST (Boston's Export Strategy Team), this cooperative effort by Boston-area graduate business schools is designed to help local companies identify and develop strategies to capture foreign markets for their products or services. BEST may serve as a prototype for initiatives by colleges, universities and local economic development and trade organizations serving specific regions within each New England state (see Appendix for some details about BEST).

Other Resources for International Trade Promotion

The Massachusetts Export Council, also located at the World Trade Center, Boston is one of 51 District Export councils that operate under the guidance of the U.S. Department of Commerce. Members include leaders in commerce, industry, academia and local government who have close association with international trade. Councils serve to provide feedback from businesses regarding the U.S. Department of Commerce's International Trade Administration. In addition, these councils sponsor workshops and seminars on exporting and help arrange export counseling for beginning exporters and potential exporters.

The Boston Customs Brokers and International Forwarders Association provides referrals for international freight forwarders and customs house brokers.

The Small Business Foundation of America Inc. which is dedicated to promoting small business through a variety of programs is located in Boston. The Foundation published a comprehensive indepth guide for small business exporters in 1983 called Exportise. It was updated just last year.

Founded in 1987, Women in World Trade fosters business opportunities and contacts among women in all parts of the world. Providing a unique forum for professional women in international trade, WWT provides networking and business development programs, an international members' directory and a quarterly newsletter on international business issues and trends.

In addition, 23 foreign consulates and other international governments' agencies are located in Boston.

Export information and assistance also is provided at the local level through Chambers of Commerce in Boston, Brockton, Fitchburg, Holyoke, Hyannis, New Bedford, Lawrence, Pittsfield, Quincy, Springfield, Watertown and Worcester.

Consultants offer specialized services to businesses that intend to export. These consultants include: export management and export trading companies that serve as representatives to manufacturers; international trade consultants; customs house brokers; international freight forwarders; translation services; and the international departments of banks. A comprehensive list is available in OITI's 1989 Export Services Guide.

Findings and Summary Comments

Massachusetts, like many other states, is now building the infrastructure for international economic competitiveness. Most economic development intitiatives in Massachusetts were initiated as the state adjusted to the decline of the 1970s. Legislation from 1975 through the mid-1980s established funding assistance and programs enabling older cities that suffered heavily from economic decline to enjoy growth in high-tech industries. This was accomplished by providing incentives for businesses to locate in these cities and incentives to developers to site major projects in areas where development most likely would not have otherwise occurred. This sound strategy has allowed comprehensive economic development to occur throughout the state and provided a foundation upon which international trade can now grow.

For international trade services, Massachusetts has relied heavily on the various regional organizations. In addition, OITI in the Office of Economic Affairs has provided a wide variety of services. Surprisingly, Massachusetts has no state-funded trade offices in other countries. Legislation is now being considered to create Asian and European offices.

The Bay State's most impressive initiative is the recent creation of Global Education Centers as resources to enhance international awareness among teachers and students in K-12. Centers are coordinated by Massachusetts colleges and universities through school district, trade associations and business partnerships. Beginning the process of heightening international awareness at a young age assures greater likelihood that citizens of Massachusetts will think more globally as they enter the job market. This program serves as a model for the other New England states.

As the Bay State faces serious considerations of budget cuts and/or tax increases related to revenue shortfalls, it is critical that policymakers consider the importance of education at all levels to the long-term international competitiveness necessary to economic growth and qualtiy of life. A well-educated, internationally aware citizenry is the key to technological innovation necessary to compete effectively in world markets. Cuts in education could set Massachusetts back tremendously in relation to other states which are prioritizing education as the key to international economic challenges.

IV. HIGHER EDUCATION AND INTERNATIONAL ECONOMIC COMPETITIVENESS

The Need for Higher Levels of Education and International Awareness and Expanded Levels of Research, Development and Technology Transfer

Because New England's economy increasingly is fueled by advanced technologies, skilled labor is critical to continued growth. International economic competition adds to our demands for a well-educated workforce, heightened levels of R&D and subsequent technological innovation. But there are signs indicating we are falling behind our economic competitors in these fundamental areas. On a national basis, the facts are disturbing:

Education and Training

- Between 20 million and 30 million adults in the United States are considered functionally illiterate.
- A 1987 survey of 5,000 high school seniors in seven cities found that nearly 40 percent of Boston seniors could not name the six New England states.
- Participation and achievement by U.S. elementary and secondary-school students in science and math lag when compared with the performance of previous years and with the performance of students of other nations. Our middle and high school students have scored at or near the bottom on international math exams for the last several years. In addition, high school graduates in both Japan and West Germany, our major competitors, are stronger in basic educational skills. Merry I. White, an analyst of Japanese educational policy, suggests that Japanese high school graduates are as well educated as American college graduates and that any worker at a Japanese factory can be expected to understand statistical material, work from complex graphs and charts and perform sophisticated math.
- Although we boast that 50 percent of our high school graduates go on to college, only 70 percent of U.S. students complete high school with their graduating class, compared with Japan's 98 percent. "Their bottom half is beating our bottom half" according to economist Lester Thurow.

- U.S. professional service industries complain about the dearth of qualified workers for entry-level jobs usually filled by high school graduates. Likewise, U.S. manufacturers are finding it difficult to recruit workers who can understand robotics and computers.

- An estimated 75 percent of today's U.S. workforce will need retraining by the year 2000.

- Recent studies suggest that U.S. universities are not turning out enough scientists and engineers--particularly at the master's and doctorate degree levels--to meet new demand in the leading-edge areas of high technology and advanced production systems. The number of engineering doctorates decreased from 2,500 in 1970 to 1,280 in 1985. In addition, only 53 percent of the engineering doctorates awarded by U.S. colleges were awarded to U.S. citizens or permanent residents. And, a shortage of top-quality applicants is expected to greet the retirement of a generation of aging science and engineering faculty.

- Top-quality students are being steered toward the lucrative professions of finance and law, creating a brain drain in manufacturing industries. The study of manufacturing processes is being neglected.

International Awareness

- Only 17 percent of U.S. public elementary schools offer any form of language instruction.

- The United States is one of the few developed nations where students routinely graduate from high school without competence in a second language. Although foreign language requirements for graduation from private four-year colleges and universities increased from 25 percent in academic year 1983-84 to 30 percent in 1988-89, such requirements at public four-year institutions increased from 9 percent to just 10 percent in those years, according to a recent national survey. Nonetheless, the language of trade remains the language of the customer. If we do not understand the customer, we will be unable to trade our goods, services and ideas.

- U.S. students, workers and consumers lack understanding of global geography and of the cultural and political differences between nations. Economic development and trade association leaders told NEBHE staff that this lack of international cultural awareness is one of the most significant hurdles they face in encouraging export trade by New England businesses.

R&D Investment and Technology Transfer

- The U.S. leadership position in R&D expenditures of 25 years ago faces a serious challenge. In 1962, the U.S. spent 2.7 percent of GNP on R&D, compared with 1.5 in Japan and 1.3 in West Germany. By 1985, the U.S. figure was still 2.7, but Japan's was 2.8 and West Germany's was 2.7. Relative to gross national product, non-defense R&D expenditures by the United States are well below both Japan's and West Germany's. Japan spent 2.8 percent of GNP on non-defense R&D in 1985, and West Germany spent 2.5 percent. The United States spent only 1.9.

- Although the United States leads the world in advanced technological industries, the annual growth rate of these industries between 1972 and 1985 was 7.6 percent, compared with Japan's 14 percent, suggesting Japan is more effective in technology transfer for high-quality product development.

- 1987 marked the second consecutive year that foreign firms topped the list of U.S. patents awarded. Japanese companies were first and second, bumping General Electric to third.

Education In The Global Economy

International competitiveness requires educational effectiveness. Having earned worldwide respect, New England's systems of higher education have at hand tremendous resources to share in solving the states' problems of economic competitiveness on several levels.

Many of the problems we face in terms of lagging worker competence and lacking international awareness have traditionally been viewed as problems of elementary and secondary education. But we can no longer afford to make that distinction. The strength of the U.S. system of higher education depends on the strength of education at lower levels. International economic competitiveness rests on the strength of both systems. For this reason, viewing the educational process as a continuum will allow more effective long-term solutions to the problems presented by the global economy.

In terms of basic literacy skills and educational level, the nation's workforce presumably falls around the middle when compared with other industrialized countries. But as our products become more highly technological and our markets become global, literacy demands increase dramatically. And the United States trails even some developing countries in initiatives on literacy, basic education and worker retraining. As a result, the United States faces competition from developing countries, which not only have lower labor costs, but also are making stronger efforts to train skilled, literate workers.

New England faces an additional challenge. The number of New England's high school graduates is projected to drop so fast that by 1994, the region will have 158,261 -- or 17 percent -- fewer high school graduates than would have been the case if high schools continued to graduate as many students as they did in 1988.

In a region whose economic "miracle" has been fueled by brains rather than brawn, this story from the high schools is very grim indeed.

The demographic changes upon us reinforce a few simple notions: New England's future economic well-being depends on our willingness to invest in education today. And we must extend the benefits of education to all New Englanders, whether they be members of minority groups who have not participated fully in higher education nor in the workforce, welfare recipients who may need further education and training to find good jobs and become independent of public assistance, or currently working people from chief executive down, whose skills must be upgraded constantly to keep pace with increasingly sophisticated business practices and formidable foreign competition.

Literacy and Education in Massachusetts·

Massachusetts is ranked 17th in the United States and tied with Maine for third in New England in adult literacy. Adult illiteracy is a serious problem in the Bay State, particularly given the fact that its economy is so knowledge-intensive. Approximately 11 percent of the adult population in Massachusetts was considered illiterate in 1985.

Massachusetts high school dropout rates have fluctuated through the 1980s. High-school graduation rates decreased from 76 percent of eligible students in 1982 to 74 percent in 1984 but rose to 77 percent in 1986. The Bay State ranked 13th nationally in 1982, 28th in 1984 and 18th in 1986.

Average SAT scores improved steadily between 1982 and 1987, (from 888 to 909) with a slight drop in 1988 (to 906). More impressive, however, is the number of Massachusetts students who take the exam -- 73 percent of those who are eligible. Though the Bay State ranked ninth in 1988 in terms of its average score, it ranked second nationally (to Connecticut) in the number of students taking the exam.

At the higher education level, Massachusetts ranked sixth nationally and second in New England in 1980, in the percentage of population age 25 and older with a college education. While the national average was 16.2 percent, and New England's average was 19.2 percent, in Massachusetts, 20 percent of this population was college-educated.

In 1986, Massachusetts' higher-education enrollment as a percent of 18-to-24-year olds was 61, substantially higher than the New England and U.S. averages of 53 percent and 47 percent, respectively. Massachusetts has the highest percentage in the region.

State government, business and education leaders should realize that raising the educational level of the population is a long-term proposition, and quick fixes simply will not work. Raising the educational levels of Massachusetts' young people in the short term will help address adult illiteracy in the long term, while leaders devise strategies to deal with the adult illiteracy that now exists.

Science and Engineering Education: Fueling a Knowledge-Intensive Economy

NEBHE completed a study in 1988 to assess the progress made by New England colleges and universities in supplying sufficient numbers of quality engineering graduates to meet industrial demands. The research showed that New England ranked first among all regions in enrollment of graduate students in science and engineering per 1,000 population. But more detailed analysis shows that while the region has responded fairly well to estimated demands in engineering and related fields at the baccalaureate level, it is increasingly clear that insufficient numbers of doctorates are being awarded to meet the demand of high technology companies and university faculties in both a regional and national context.

Science and engineering education in New England serves as a national resource and Massachusetts colleges and universities are responsible for producing the majority of graduates. Only 5.3 percent of the U.S. population calls New England home and just 2.5 percent live in Massachusetts. But over 8 percent of all engineering degrees were awarded by New England universities and over 5 percent by those in Massachusetts in 1987, according to NEBHE analysis of data from the Engineering Manpower Commission. Likewise, Department of Education data indicate that in 1985, both New England and Massachusetts educated even higher percentages of the nation's mathematicians and physical scientists. In addition, the region educates scientists and engineers at the advance degree levels in even greater numbers in almost all cases, as suggested by the following table.

TABLE 7

Science and Engineering Degrees Conferred
New England and Massachusetts As a Percent of U.S. Total: 1985

		N.E.	MA
Baccalaureate:	Mathematics	9.6	4.6
	Physical Sciences	7.5	4.2
	Engineering	7.9	4.9
Master's:	Mathematics	9.0	6.7
	Physical Sciences	7.0	3.5
	Engineering	9.0	6.8
Ph.D.:	Mathematics	12.3	7.9
	Physical Sciences	10.9	7.4
	Engineering	9.5	7.7

Note: New England's population as percent of U.S. total = 5.3
Massachusetts' population as percent of U.S. total = 2.5

Source: NEBHE analysis of U.S. Department of Education data.

Massachusetts colleges and universities clearly serve both the region and the nation well in the production of scientists and engineers. As will be pointed out later (see Section titled R&D Investment and Technology Transfer), this university-based science and engineering resource serves the nation well in multiple ways.

Massachusetts Initiatives to Heighten Levels of Education

The Corporation for Enterprise Development gave Massachusetts a "B" on its 1988 state-by-state report card for state educational initiatives. The state was ranked 17th nationally in this capacity. Public-education spending for grades K-12 and particularly for higher education are not high when compared with the actual wealth of Massachusetts' residents. The Bay State ranked 15th in K-12 spending and 49th in higher education per pupil as a percent of per-capita income in 1986. However, pupil/teacher ratios were quite low and teachers' salary increases between 1986 and 1987 were about average. As a result, Massachusetts ranked fifth and 20th nationally in these last two areas, respectively.

In the area of adult literacy, Massachusetts has a very comprehensive set of programs. At the state level is the Workplace Education Program, funded by the offices of labor, education and economic development. Programs utilize existing local educational infrastructure including Private Industry Councils (PICs), local education and training partnerships/consortia, college and university outreach and community service programs, local government employment and training offices, and corporate training programs. Courses in English-as-a-Second Language, basic math and reading are offered.

In addition to state government initiatives, the Bay State has an organization of students, volunteers, educators, business and labor leaders and public officials who have joined together to form the Massachusetts Coalition for Adult Literacy (MCAL). In its effort to expand and strenghthen adult literacy efforts in Massachusetts, MCAL has established a toll-free information and referral hotline and regional coalitions to work on local adult-literacy issues.

Massachusetts colleges and universities have been particularly responsive to their local communities in joining coalitions and other consortia. In this regard, Harvard University, UMass-Amherst, Southeastern Massachusetts University, Roxbury Community College, Massachusetts Bay Community College, Quinsigamond Community College, and Bristol Community College are a few of the institutions that have made impressive efforts. Local Chambers of Commerce also have been particularly responsive to the need for workplace literacy programs.

Massachusetts was one of 13 recipients of the Gannett Literacy Challenge, the first large-scale non-government funded program to stimulate efforts among adult literacy groups and agencies. Maine and Rhode Island were also recipients.

Improvement of public schools was the No. 1 public policy priority for Massachusetts business, government and education leaders surveyed in NEBHE's 1987 Future of New England Survey. Maintaining a strong economy ranked second among 19 issues for consideration. Improving public schools was further emphasized when leaders suggested that higher education might more effectively join in partnership with the broader community to improve the quality of teacher education. In addition, leaders emphasized the importance of promoting collaboration between education, business and government to cope with the variety of problems related to sustaining the Bay State's economy. Indeed, Massachusetts has an impressive history of business and education partnerships.

Bay State Business, Government and Education Partnerships

In addition to those established to deal with issues of adult literacy, well over 100 partnerships exist in the Bay State to tackle issues of basic academic skill improvement, to generate special programs for "At-Risk" students, to create intergenerational programs, professional development of teachers and teacher training programs, and to provide special education, vocational/technical, special school "bank" and other programs. The state Department of Education provides local groups with comprehensive step-by-step guides for establishing and maintaining effective partnerships.

Many involve colleges and universities working with public schools, businesses and business organizations at the local level. Many Chambers of Commerce are particularly active in these partnerships, as well. In Lawrence, for example, the Chamber has placed education at the top of its priority list. Its Business/Education Collaborative has over 70 participating businesses, hospitals, independent schools and colleges, and sponsors an Adopt-A-School Program (all schools are expected to be adopted by September 1989), a Read-Aloud program for K-12 children, Academic Olympics and a Community Seminar/Productivity Award.

Biotech Partnership

In February 1989, The Massachusetts Biotech Council advocated two bills to support life-science education. The first bill would establish a commission to study life sciences curricula in Massachusetts elementary, secondary and vocational schools. The Council is concerned about the adequacy of science education and about the shortage of entry-level lab technicians that are critical to this industry's growth. The second bill would establish a deduction for businesses that contribute property to educational institutions for use in teaching life sciences. These bills were triggered, in part, by a successful program developed by Serano Laboratories and Randolph High School. Through the program, students and teachers obtain equipment, scholarships, development grants and internships at the laboratories. This is yet another example of a unique partnership to bolster education in the Bay State.

Industry estimates suggest that Massachusetts could be home to as many as 150 biotech firms, employing 75,000 people and generating $3 billion in revenue by the year 2000. As noted in NEBHE's Biomedical Research and Technology, a report prepared by NEBHE's Commission on Academic Medical Centers and the Economy of New England in June 1988, state and business leaders must take care to preserve the stream of biomedical technology that has flowed to the region both from area universities and the several biotech firms that already exist if the growth of biotechnology is to actually benefit Massachusetts rather than other states or other nations.

Lack of International Awareness

In 1987, NEBHE completed a comprehensive study of the ways New England college and universities were adapting curricula and related activities to provide the new understanding and competencies necessary in a global economy. Using a case study approach, NEBHE examined 40 colleges and universities, including public and independent two-year and four-year institutions, across the region. (This study is constantly updated in conjunction with state legislative briefings.) NEBHE considered institutional planning, business and liberal arts curricula, foreign languages, area studies, internationalization within various academic disciplines, foreign-student enrollment, study-abroad programs and library resources. The study found that the change occurring along the international dimension was one of the most powerful substantive developments in the history of higher education. But it also warned that more must be done.

Campus-based International Initiatives

What follows is a sampling of campus-based activities to promote international awareness among students in Massachusetts:

- Under contract with the U.S. Army, Boston University operates graduate programs at 12 overseas sites. B.U. became the first American university to have a graduate management program in Europe when it established Boston University Brussels in 1972. B.U. also offers an Asian Management Institute serving Korean students on the Boston campus.
- Tufts University offers more than 50 international programs and projects that are currently being examined to see how they might be interrelated and strengthened across the university. Activities include a new China exchange program, a veterinary medicine project in Sahel and postgraduate professional education in periodontics and orthodontics for French, Italian and Spanish dentists in Europe. Tufts international activities are funded at $5.5 million annually.

- UMass-Amherst completed a comprehensive cost/benefit analysis of its international activities that frame the university's new role in an increasingly global era. *The Whole is Greater than the Sum of Its Parts* reviewed quantitative and qualitative aspects of internationalization across exchange programs, research, area studies, foreign student programs and curriculum. A comparative analysis of the university and its peer universities was included and more than 25 recommendations were made to enhance the university's international performance.

- Harvard University established a University Committee on International and Area Studies in 1986. Its first product was a 1987 directory of faculty and staff who have expertise in international issues to serve as a guide for corporate, government and intra-campus contacts.

- Harvard's Center for International Affairs recently established an Academy for International and Area Studies to provide more opportunities for students and faculty in area studies and to advance knowledge internationally.

- Boston College established a Committee on International Education to study enrollment, curricula and grants in an international context.

- Bentley College has committed itself to comprehensive internationalization resulting from a 1986 study by its Internationalization Bentley Committee. Efforts include encouraging and funding sabbaticals abroad, involving visiting scholars in business disciplines, recruiting more foreign students and internationalizing the liberal arts program. A college-wide International Council was established, followed by the creation of an International Center in 1987.

- In 1986, Boston University created the position of Vice President for International Projects. The Center for International Relations and its Directorship was established in 1982.

- UMass-Amherst's Office of International programs was established in 1969, focusing upon multidisciplinary research in an international context. Similar in focus, Harvard's Center for International Affairs was established in 1968, while Wellesley's International Center was initiated in 1972.

- International Business Programs have been created in several major Massachusetts universities: Harvard led the way in 1965 and now also offers a doctoral program in international business; Northeastern's program has enrolled over 200 students; the Fletcher School of Law and Diplomacy at Tufts created its program in 1981, while MIT has internationalized all the functional fields of business through a comparative approach.

- Simmons College has the only *undergraduate* International Management Program in New England, which requires advanced foreign language achievement; it is one of the leading majors at the college.

- Bunker Hill Community College has requested approval from the state Board of Regents for an associate's degree program in international business. This request evolved from the college's pragmatic Export Education program that has served the small business community for several years. The college received funding for this program in 1986 and 1987 under Title VI-B, the International Business Programs section of the Higher Education Act.

- In 1986, Babson College started blending liberal arts and business courses in a cluster-course mode. The liberal arts faculty constitutes a division within the College of Business Administration.

- UMass-Amherst initiated an International Fellows Program in 1984 with the London Business School. It is an intense two-week program for mid-career professionals. Similarly, Boston University has received corporate contributions to develop an international executive development program geared for high-tech industries.

- Boston University recently developed a master's degree program in International Relations (IR) and dual master's degree programs in IR/Communications and in IR/Business Administration. B.U. also has the largest program in developmental economies, while Williams College has the second. Both focus upon Asia, Africa and Latin America and serve mid-career officials from these three parts of the world. The programs lead to master's degrees, and at B.U., doctorates, as well.

- Brandeis University recently created the Lemberg Program in International Economics and Finance, a master's program with a foreign language and study-abroad requirement. Undergraduates can enroll in it as a five-year program, an undergraduate-through-master plan of study.

- Clark University holds the distinction of having offered the nation's first doctorate in International Relations, shortly after World War I. In addition, Clark's Center for Technology, Environment and Development focuses on international development related to resources, food production, labor markets, migration and regional economic planning, as well as on environmental issues.

- In 1987, Tufts University adopted a liberal arts foundation course in World Civilization.

- Simmons College has introduced a topical course within its Spanish language department, "The Multinational Corporation from a South American Perspective." Simmons is also recruiting students in China for a new master's program in English and American Literature for Chinese Students.

- Williams College created a Center for Foreign Languages in 1986.

- Since 1986, Chinese language has been offered at Boston University, Brandeis and Williams College. Williams College added Japanese in 1987.

- A Five College East Asia Language program enables students at Amherst College, Hampshire College, Mt. Holyoke College, Smith College and UMass-Amherst to take four years of Chinese and Japanese. Five Colleges Inc. has broadened offerings to include an undergraduate certificate program in African Studies. Five Colleges also offers a Program in Canadian Studies and Latin American Studies.

- MIT's Asian student presence is known worldwide. Its over 4,000 Asian students represent one-fifth of the student body (including permanent residents). In addition, the 1986 faculty and staff included 157 Japanese, 124 mainland Chinese, 51 Taiwan Chinese and 33 Koreans. MIT receives substantial sums of funding from Japanese corporations which have endowed nearly 20 professorships and supported several technology development projects.

- Mainland Chinese who only recently began to arrive at American universities are the largest foreign student group at Clark University. In 1987, 154 mainland Chinese were enrolled at UMass-Amherst, while Tufts is bringing to the campus Chinese mid-career managers for a 15-month program of academic studies and industrial internships.

- Harvard University's East Asia Center is designated as a national graduate-level resource center under Title VI of the Higher Education Act. Harvard also has a special Program on U.S.-Japan Relations that involves 30 researchers focusing on such topics as coordination of economic policy and security relations in a global context. The University's Russia Research Center has only 15 places, but attracts more than 100 applicants annually.

- Brandeis recently created an interdisciplinary major in European Cultural Studies. Based in literary studies, it links study in any combination of seven disciplines.

- Tufts Nuclear Age History and Humanities Center offers courses in nuclear disarmament, attracting more than 400 students annually.

- Boston University's African Studies Center is designated as a national resource center under Title VI of the Higher Education Act and attracts scholars and research associates from throughout New England and from Africa, as well.

- Brandeis is the home of the Lown School for Near Eastern and Judaic Studies. UMass-Amherst also has developed a Judaic and Near Eastern Studies Program.

- In 1986, MIT created a Middle East Program in graduate studies focusing on technology development and policy. The program was conceived based on corporate experience in the Middle East. It concentrates on socio-economic change, history, politics, capital flows, technological change and institutional development. It is interdisciplinary in nature, drawing faculty from seven major programs.

- Canadian studies are available to students at UMass-Amherst, Bridgewater State College, Plymouth State College, and Southeastern Massachusetts University.

- In 1987, UMass-Amherst established an Institute for North American Trade Relations to undertake research on the trade relationship between Canada and the U.S. By 1991, the Canadian Deparment of External Affairs is expected to have contributed $250,000 to the Institute for research, conferences and course development.

- Since 1979, Harvard's Center for International Affairs has been host to the University Consortium for Research on North America, a partnership of Harvard, Brandeis and Tufts.

- Study-abroad programs have recently expanded at several universities across academic disciplines and throughout the world at UMass-Amherst, Fitchburg State College, Clark University, Northeastern University and Boston University. New international internship programs have been established at Lesley and Babson colleges, and at Northeastern and Boston universities.

- Harvard's Center for International Affairs will establish the John M. Olver Institute for Strategy Studies on July 1, 1989. This center will be devoted to the study of national security affairs.

- NEBHE manages the New England side of the New England/Quebec Student Exchange Program. The program enables students to study at Quebec institutions while paying tuition at their sponsoring home campuses. Eighteen institutions of higher education in Quebec and 36 public and independent colleges and universities in New England participate. During the 1987-88 academic year, 42 students participated from the two regions.

Through early 1987, Massachusetts colleges and universities, like their counterparts in other New England states, had concentrated their internationalization efforts on curriculum development. Although many of these initiatives have been unique and impressive, comprehensive curricula planning typically lacked focus on the global economy.

While foreign-language enrollments have risen sharply after a decade of decline, few business students study foreign languages. And there is very little global business perspective in liberal arts programs, even though most liberal arts students eventually go to work for companies which are directly or indirectly involved in world trade.

In addition, very few overseas internships focus on business. Very few post-doctoral research fellows are funded for overseas research positions. And those who do go overseas generally must complete a second post-doctoral assignment in the United States in order to be adequately connected to secure future employment. As a result, these research fellows are discouraged from going abroad.

Foreign-Student Enrollment

Growth in foreign-student enrollment in New England as well as the nation has flattened during the 1980s in relation to the tremendous growth that took place in the 1960s and 1970s. But foreign-student enrollment in New England slowed to a lesser extent. The number of foreign students in New England grew from 23,191 in 1983-84, to 27,702 in 1987-88, less than 20 percent growth over the four-year period, but still substantial, compared with the national increase of 5 percent (339,000 to 356,000).

More troubling is the relatively small number of Americans studying abroad. According to the Institute of International Education's 1986-87 "Open Doors" survey, 48,483 Americans were studying for credit abroad, compared to 349,609 foreign students studying for credit in the United States. Equally striking: while 80 percent of the Americans were studying in Western Europe and only 5.4 percent were studying in Asia, students from Asia represented about half of the foreign students in the United States. New England has proportionately more students from Europe and Canada and fewer from Asia than does the nation as a whole. Institutions in the three northern New England states have been especially attractive to Canadian students. But the asymmetry of the foreign-student exchange is further revealed in how foreign and American students, respectively choose their fields of study.

Foreign students are learning an enormous amount about science, engineering and business management in the United States. U.S. students overseas are learning almost nothing about science and business in their host countries. Primarily, these U.S. students abroad are studying fields associated with U.S. undergraduate curriculum, such as Western history, philosophy and culture.

More must be done to encourage study-abroad in our institutions of higher education, not only in Western nations but throughout the world. In addition, the foreign students here in New England could serve as tremendous resources of cultural knowledge not just for college students and faculty, but for students and teachers in middle schools and high schools and the general public.

Business-Higher Education Lack Coordination

NEBHE's 1987 case study analysis of 40 New England colleges and universities suggested that leaders of the region's businesses, governments, economic development agencies and trade associations were increasingly focusing on international issues on a tract parallel to that of the region's colleges and universities, but that efforts by the different parties were rarely coordinated.

Although higher education has international resources relevant to the business community, and foreign investment tends to be attracted to areas offering educational advantages, New England communities had not yet developed business-higher education partnerships for international economic effectiveness. Business leaders have expressed growing interest in the international economy, yet continuing education and executive development programs related to international business issues were and still are, lacking.

It is critical that efforts be made to broaden the dialogue and improve international awareness among students, faculty and citizens in general.

In the area of R&D and technology transfer, on the other hand, Massachusetts has benefited tremendously from the informal relationships between the university and high-tech research communities. This collaboration has generated impressive advanced technological industrial development.

R&D Investment

New England's leading edge in basic research is striking and gives the region a major competitive asset in the international marketplace. But the nation's ability to transfer research-spawned knowledge to the world marketplace will be crucial to the nation's trade future and the careers of today's undergraduates. Yet on a national basis, technology transfer has not been adequate to transform research into economic gain. Many discoveries born of American research become products made by other foreign competitors. Students, businesses and policymakers do not have an effective network to apply new knowledge on a timely basis.

The New England region relied upon informal relationships between university researchers and resulting spinoff businesses through the 1970s. In the early 1980s, economic policymakers and research universities across the nation begin to understand the serious implications for all sectors when regional economies failed or stagnated. The result was a concentrated effort to enhance university-based technology transfer and technical assistance initiatives in order to nurture the diversification of local economies.

But because the recession of the early 1980s did not affect the New England states as severely as states in other regions, the promotion of technology transfer and technical assistance has lagged in this region. Now, as the region's economy seems to be peaking and international competition is intensifying, purposeful action is critical to sustaining long-term economic development.

The nation's long-term commitment to research and development has served

72

as a seedbed for new industrial products and processes, innovative capacity and productivity gains. Federal funding of basic and applied research has been vital in sustaining a prosperous economy. It has also created a partnership among government, business and academia, which is responsible for our international leadership in scientific and technological discoveries. Since World War II, federal support for basic and applied research has grown substantially, and New England organizations have been leading recipients of the federal funds.

The region's strong R&D infrastructure, particularly through Massachusetts research universities, has allowed for the evolution of the computer industries of the 1970s and the biotechnology, artificial intelligence and software engineering industries as well as others developing in the 1980s. Nurturing R&D is crucial for further state and regional economic development.

Massachusetts' Share of Federal R&D

Between 1980 and 1985, federal R&D funding to all Massachusetts organizations increased, but in 1986, funding remained at its 1985 level. Massachusetts ranked an impressive third nationally in federal R&D funding in 1980, 1985 and 1986, behind California and Maryland.

Almost 76 percent of all federal funds awarded to Massachusetts are from the Department of Defense (DOD), a proportion substantially higher than the 65 percent national average. Almost 15 percent of the state's federal R&D funds are from the Department of Health and Human Services (HHS), an indication of the state's strength in biomedical research. This HHS money includes significant funding by the National Institutes of Health (NIH).

The DOD award to the Bay State represents 7.5 percent of its total award, while HHS's is 8.4 percent. In awards from these two agencies, Massachusetts ranked third and fourth respectively among all 50 states. Massachusetts ranked among the top 20 states in three other funding categories: total funds from all agencies (3rd), NASA funds (12th) and Department of Energy funds (14th).

Federal R&D funds to colleges and universities in Massachusetts declined from 21 percent of those awarded to all organizations in 1980 to 14 percent in 1986. Whereas 1980 funds awarded to Massachusetts industries was 52 percent of all federal awards to the state in 1980, it was 56 percent by 1986. This is indicative of the sharp increase in DOD research during the Reagan administration that benefited industries of Massachusetts considerably.

Total university-directed federal R&D funding is awarded fairly evenly by the various agencies, with the largest share, 37 percent, awarded by HHS. The Department of Education awarded 19 percent, DOD awarded 19 percent, The National Science Foundation (NSF) awarded 15 percent, and the Department of Energy awarded 10 percent of all funds directed to college and universities of Massachusetts.

Of the 10 universities in New England which rank among the top 100 institutions of higher education nationally for R&D obligations, six are in Massachusetts. They are: MIT (2), Harvard (13), Boston University (39), UMass-Amherst (66), Woods Hole Oceanograpic Institute (78) and Tufts (92). Of the top 40 in the region, 22 are located in Massachusetts.

MIT ranks first in New England in funds from the DOD, DOE, the NSF and NASA, and second, third, and 11th in the region in Department of Commerce, Health and Human Services and Department of Education funds. UMass-Amherst ranks first regionally in Department of Agriculture funds awarded, while Tufts was first in Environmental Protection Agency awards.

In addition to MIT's strength in DOD awards, nine other Massachusetts institutions are among the 15 top regional DOD receivers: Woods Hole (2), UMass-Amherst (3), Harvard (4), Boston University (7), Northeastern (9), University of Lowell (12), Wentworth Institute of Technology (13), Emmanuel College (14) and Boston College (15).

Of the top 10 regional colleges and universities receiving Department of Education funds, six are in Massachusetts: Boston University (1), UMass-Amherst (2), Northeastern (3), Harvard (5), Boston College (9), and UMass-Boston (10).

Two other Bay State universities rank among the top five in DOE funds with MIT. Harvard University ranks fourth while UMass-Amherst ranks fifth regionally.

In HHS funding, Harvard ranks second in the region, while MIT, B.U., Tufts, and UMass-Medical School ranked third, fourth, sixth and seventh, respectively, in New England.

Of the top 10 NSF awardees in the region, seven are in Massachusetts. Besides MIT, which was first, are Woods Hole (2), Harvard (3), UMass-Amherst (6), Boston University (8), Brandeis (9) and Northestern (10).

R&D Expenditures at Colleges and Universities

Colleges and universities receive R&D funding from several different sources. In addition to those awarded by the federal government, funds are received from state and local government, industry, internal institutional sources and other more minor sources.

On the expenditure side, Massachusetts colleges and universities fare much better than the nation and region in two sources of funds. Slightly more than 75 percent of R&D expenditures are from the federal government, compared with the nation's 62 percent. Almost 9 percent are funded by industry, versus the national average of 6 percent average. State and local governments contribute a rather small share of R&D funding to Massachusetts colleges and universities (1.8 percent). The New England average is 2.3 percent; the national average is 8.4 percent. Nationally, state and local government expenditures per capita are $3.67, in Massachusetts they are only $1.94. In addition, Massachusetts universities rely less on institutional funds than those in other regions: 4.9 percent versus the nation's 16.6 percent average.

Broken down by academic discipline, Massachusetts shows a more even distribution of R&D expenditures than many of the other New England states. More than 37 percent of research funding is spent in the life sciences, followed by 22 percent in engineering, 19 in the physical sciences and 9 percent in environmental sciences. Though only 6 percent occurs in the social sciences, this is above the national average of 4 percent. These figures allude to the collective strength of Massachusetts research universities across several disciplines.

MIT ranked second nationally in total university-based R&D expenditures, while Harvard ranked 14th. Boston University and UMass-Amherst showed marked improvement in rankings from 1985 to 1986, from 76th to 67th, and from 82nd to 78th, respectively. Woods Hole was ranked 82nd.

Nationally in 1986, MIT ranked 16th, Harvard ranked 28th and UMass-Amherst 59th (up from 69th in 1985) in R&D from non-federal sources. MIT led the nation in industrial-sponsored expenditures, while Harvard was 26th, UMass-Amherst was 50th, Worcester Polytech was 65th and B.U. was 98th.

UMass-Amherst ranked 53rd nationally in terms of R&D expenditures by public institutions of higher education, while UMass-Medical School ranked 100th.

Among independent colleges and universities nationally, several top rankers were from Massachusetts. They were: MIT (2), Harvard (5), B.U. (23), Woods Hole (26), Brandeis (37), Tufts (39), Northeastern (55), Worcester Polytech (63), Boston College (65), Clark (73), Smith (84) and Wellesley (99).

National Institutes of Health Funding (NIH)

New England ranked first among all regions of the nation both in terms of university-based federal R&D obligations and university-based R&D expenditures on a per capita basis. With only 5.3 percent of the nation's population, New England captured 9.3 percent of federal funds awarded to universities nationally. Likewise the region spent 9.4 percent of national university-based R&D funding from all sources. The most impressive statistic, however is the region's No. 1 per capita position in NIH awards. Almost 15 percent of all NIH R&D awards were to New England institutions in both 1986 and 1987. Massachusetts received 72 percent of those regional awards, an indication of the strong biomedical research activity in the Bay State.

Among all domestic institutions across the nation in 1987, 11 percent of the top 100 NIH awardees are in Massachusetts: Harvard (6), Brigham and Women's Hospital (24), MIT (25), Massachusetts General Hospital (32), Boston University (36), Dana Farber Cancer Institute (44), UMass (49), Children's Hospital (65), Tufts (70), New England Medical Center Hospitals (78) and Beth Israel Hospital (93).

Among the top 100 institutions of higher education across the nation in NIH funding, six are in Massachusetts: Harvard (6), MIT (23), B.U. (32), UMass (42), Tufts (60), and Brandeis (85).

Nine New England medical schools are among the top 100 in the nation in NIH funds. Of the nine, four are in Massachusetts: Harvard (13), B.U. (29), UMass (36) and Tufts (52).

New England also has a large number of independent hospitals, many of which receive NIH awards. Several are teaching hospitals affiliated with university medical schools. Nine Massachusetts independent hospitals are among the top 20 nationally: Brigham and Women's Hospital (1), Mass. General (2), Dana-Farber Cancer Institute (3), Children's Hospital (4), New England

Medical Center (6), Beth Israel (7), Mass. Eye and Ear Infirmary (14), New England Deaconess (18) and University Hospital (20).

Summary Remarks

New England's national leadership in university-based R&D funding and expenditures is firmly established due to the collective strength of Massachusetts universities, research institutes and medical schools. The prestige of the state's university-based R&D infrastructure is famous throughout the world, and large numbers of international researchers are attracted to the region because of this. Moreover, this prestige crosses several academic disciplines, adding diversity to that strength. Policymakers might consider expansion of funds for applied R&D to enhance the economic benefit presented by this resource in the Bay State. To date, little has been allocated for this purpose. Per capita R&D expenditures from state and local sources in Massachusetts is only $1.94, compared with the national average of $3.67.

Technology Transfer and Technical Assistance

In the areas of technology transfer and technical assistance, many of the nation's colleges and universities have taken creative steps to help improve the health of local economies. Various initiatives have expanded technical and entrepreneurial assistance in economic and community planning, worker retraining, science and engineering technology transfer as well as consultations to small and medium-sized firms. Further examples of such technology transfer initiatives include: the creation of new business/university research parks, university industrial liaison programs, scientist exchange programs; technical and administrative support to university researchers interested in moving basic research forward for application. Some universities have provided incubator space at research facilities for new business ventures and established joint venture capital funds, as well. A sampling of university-based initiatives in Massachusetts follows.

Technology Transfer

- MIT maintains a worldwide reputation for transferring faculty research and ideas to the marketplace through several mechanisms. There is extensive faculty consultation with industry. The Industrial Liaison Program, has a campus office and office in Japan, to keep industry up-to-date on new technologies being developed at MIT and to assist them in assessing market potential. The Technology License Office assists university researchers in licensing patent rights to the innumerable spin-off businesses as well as established university research related businesses interested in technology development.
- Through research at the Harvard-MIT Division of Health Science and technology (which awards joint M.D./Ph.D degrees in Biomedical Engineering), the MIT Center for Cancer Research, Whitaker College of Health, Science, Technology and Management, MIT's Whitehead Institute for Biomedical Research, the medical schools at Harvard University, Boston University and Tufts University, UMass Medical Center in Worcester, and all their affiliated teaching hospitals, and several Divisions of Life and Biological Sciences of the state's major research universities are partially responsible for generating the biotech industries that now account for more than 5,000 jobs and 4 percent of the total number of high-tech firms in the state.
- In response to education and training needs of the burgeoning biotech industry of Massachusetts, several universities responded with new academic programs: Worcester Polytech and Boston University with training of biotech-related technicians; WPI, B.U. and Tufts with master's degree programs in Biotechnology; WPI and Tufts with doctoral programs in Biotechnology; and Harvard-MIT with a M.D./Ph.D. program in Biomedical Engineering. WPI also sponsors a doctoral program in Biomedical Sciences with the Worcester Consortium doctoral program that involves Clark University, UMass-Medical School and the Worcester Foundation for Experimental Research. More traditional Marine Science, life science and developmental biology programs at the state's research universities have also been responsible for training in biotechnology. B.U. also has an associate of science degree in biomedical laboratory science.
- The National Science Foundation selected MIT to be the first national Biotechnology Process Engineering Center.

- The work of Harvard Medical School geneticist Dr. Philip Leder and Genentech Inc. senior scientist Timothy A. Steward (formerly a Harvard researcher) created a transgenic mouse in 1986 that led to the issuance of a patent in 1988 to Harvard University for the first genetically altered animal.

- In 1988, Harvard Medical School established an independent fund to invest in the development of technologies and new biomedical products from research of its faculty members. The Medical Science Partners fund seeks to raise over $30 million from a limited number of qualified investors for Harvard research and technology development.

- WPI offers a course in bioprocess technology through partnership with the Bay State Skills Corporation (BSSC) to provide technical training necessary to run large-scale bioprocess equipment.

- The Massachusetts Biotechnology Research Institute (MBRI) is a consortium of seven Worcester-area university and research institutions actively involved in stimulating technology transfer activities in the state through capital assistance, incubator facilities and support services. MBRI is located at Worcester's Biotech Research Park, one of the state-designated Centers of Excellence.

- B.U. has invested over $25 million in Seragen Inc., a biotech firm founded by two B.U. scientists in 1979.

- The University of Lowell's College of Engineering has created a Center for Productivity Enhancement to transfer engineering technology more efficiently and effectively.

- Harvard, MIT and Boston University have created the New England Research Network (NEARnet), utilizing microwave technology to exchange and share scientific and research data more efficiently and effectively.

- In May, 1989, MIT, AT&T and IBM announced that they were forming a consortium to do research aimed at developing applications for new "high-temperature" superconductors to high speed microelcetronic devices for use in computers, telecommunications and military systems. The Consortium is expected to raise $4 million to $6 million in financing from the Pentagon, with consortium members either contributing an equal or greater match.

- In the area of artificial intelligence, federal and private grants and contracts from foundations and industries provide approximately $5.4 million annually to UMass-Amherst's Department of Computer and Information Science to investigate how machines can mimic human behavior.
- UMass-Medical School's Diabetes-Endocrinology Research Center, as one of only 12 combined research, teaching and service programs in the nation, receives national recognition for its research on diabetes.
- Through Federal Sea Grant Program funding, MIT has designed offshore oil structures to help reduce the risk of employee injuries, improved fishing gear for a more effective and selective catch, and assessed the health benefits of fish oil.

Technical Assistance

- MIT has prioritized the education of production engineers through its "Leaders in Manufacturing" master's degree program. The program is designed to more effectively define engineering problems and problems of corporate management strategy as two sides of the same coin.
- UMass-Amherst has created a cooperative education program with companies in Japan to provide new internship experiences. This could have long-term benefits to industries here in the United States, as technology transfer from Japan then begins to take place.
- UMass-Amherst's Small Business Development Center provides comprehensive market studies of specific countries for individual small and medium-sized firms interested in expanding or initiating export trade. Branch SBDC's are also located at Boston College, Clark University, Southeastern Massachusetts University and the University of Lowell.
- Bunker Hill Community College's International Business Program provides seminars and general introductory courses for businesses interested in exporting. Program administrators also work closely with SBANE's international committee and the various state and regional organizations charged with promoting international trade by Bay State companies.
- Literacy Corps students majoring in sociology, educational psychology or economics at Boston College, as well as Stonehill College, Endicott College, Bunker Hill Community College and Wheaton College complete required courses and do a practical laboratory project tutoring Head Start students in basic literacy skills for 60 hours per semester. This pilot project was made possible through a Bank of Boston grant.
- Brandeis University's Center for Human Resources (affiliated with the Heller School for Advanced Studies) is one of the nation's leading organizations providing research and direct assistance to programs serving at-risk youth.

- UMass-Boston's John W. McCormack Institute of Public Affairs was established in 1983 to provide public policy research of concern to the city of Boston and Commonwealth of Massachusetts.

- University of Lowell has recently created a demonstration school for multilingual and multicultural settings. It will serve 200 children in English, Spanish and Khmer languages, starting with pre-school and later adding elementary grades. Teachers will be granted two-year sabbaticals from their local district with the expectation that they will teach co-workers what they have learned. Students speaking Spanish or Khmer as a first language will be encouraged to retain their native language and culture while learning English.

- Harvard University joined forces with adult literacy centers in Cambridge and Boston to explore the possibilities of creating television programming comparable to "Sesame Street" for adults, provide a teacher training program and mount an adult literacy research agenda known as the Harvard Adult Literacy Initiative.

- The Tufts Education Department has joined with the Somerville and Malden School districts to create a prototype curriculum for bilingual math and science programs for secondary school students.

- A Salem State College geography professor and Winchester High School history and Asian studies teacher have spearheaded the Greater Boston area's "Academic Alliance" program, funded by the National Geographic Society. In an effort to expand understanding of international geography, the alliance between area colleges and universities offers a three-week teacher education institute at Wellesley College and Saturday workshops during the school years. It also issues a quarterly newsletter that provides lesson plans and reading assignments to broaden international education in local schools.

- Tufts University's Lincoln Filene Center is one of just a handful of centers in the nation with the goal of fostering civic involvment.

- With NSF funding, Harvard created a program to help improve high school students' understanding of science through astronomy. Known as Project STAR, the program was piloted by 25 junior high and senior high school teachers who did summer workshops in Cambridge to help revise and refine teaching modules. Now completed, the program will reach 500,000 students nationwide.

- The University of Lowell conducts a Secondary School Program -- five weeks of college-level coursework for high school juniors and seniors that includes field trips to high tech firms.

- The Massachusetts Institute for Social and Economic Research (MISER) at UMass-Amherst provides comprehensive demographic and economic analyses for a wide variety of government, social and economic organizations throughout the state to effect informed public policy debate and planning.

- The UMass-Amherst Institute for North America Trade Relations was created in 1987 to undertake research on trade relationships between the United States and Canada. The Institute offers colloquia and lectures and prepares teaching modules for business schools offering comparative perspectives on Canadian and American management.
- Harvard's Graduate School of Education's Office of International Education operates a Speakers Bureau that sends Harvard foreign students and American students with international experience into local schools to talk about life in other nations. The International Speakers Bureau Schools Outreach Program sponsors talks by qualified students, graduate or undergraduate, with primary and secondary schools in Cambridge and the surrounding area.
- Harvard's Center for International Affairs sponsors a series of conferences for senior management officers of U.S. companies concerned about economic policy, global competitiveness and other international issues affecting the United States.
- B.U. is sponsoring an "Entering International Business" seminar with the Bay States Skills Corp. for top executives of small companies and middle managers of area firms wishing to initiate or expand export programs.

Massachusetts Global Education Centers

- With state funding, five global education centers have been created at Clark University, Framingham State College, Tufts University, UMass-Amherst and Wellesley College. These global education centers provide teacher training and curriculum resources for public school teachers in 93 participating towns. (For more detail on specific activities of the five centers, please refer to the Appendix.)

Coordinating Efforts

As noted previously, NEBHE's 1987 case study revealed campus efforts toward internationalization were not coordinated with those of business, government and the economic development community. Research conducted in conjunction with preparation of this briefing paper has found that in 1988 and 1989, much more is happening to foster this coordination.

University faculty and administrators have traditionally shared their work within academia. On the relatively rare occasions when findings have been shared beyond the academic community, this information has generally been shared at the national level. Only in the last few years has attention shifted to the state level. But it is the state policymakers who could benefit significantly from university-based research that will affect the broader community.

Because this reaching out to an expanded community is new to many college and university faculty members, leaders of higher education should foster such public service among faculty. Complicating this is the fact that faculty promotion and tenure are often based strictly upon teaching and publications, leaving little time for service to the broader community. Particularly in the case of publicly funded institutions which often include community service as part of their mission, more should be done to encourage faculty to serve on community agency boards, create alliances with local schools, provide policy analysis to local government, counsel small business in export trade, provide technology transfer and technical assistance to high tech businesses and the like. Government and business leaders should take care to foster a broader relationship with higher education for greater gain at the local level.

Despite these areas that need improvement and expanded cooperation, Massachusetts' campuses, businesses, government offices and economic development groups are laying a solid foundation to ensure the state's global economic competitiveness. Building upon this foundation should now be a major goal.

V. Recommendations

The following recommendations aim to enhance the Massachusetts higher education community's reponse to the challenge of global economic competitiveness. These recommendations do not relate strictly to higher education initiatives, but all require the diversity of talent that exists in the academic community in partnership with business and government leaders.

Education and Training

To leaders of state government, business and higher education:

1. Expand the concept of campus-based global education centers to:
    - Help local teachers at all levels upgrade basic education;
    - Develop model instructional materials to accomplish this;
    - Coordinate university-based speakers bureaus to encourage early interest in science, math and engineering careers;
    - Expand opportunities for science and math education in smaller rural areas through telecommunications.
2. Through the MASSJOBS Council, evaluate Rhode Island's Workforce 2000 Council's funding mechanism as a model to more effectively fund education and training programs for workers and welfare recipients.
3. Assure that results of the Mass. High Tech Council's annual survey on industrial supply and demand for scientists and engineers is shared across sectors for long-term planning purposes on a statewide basis.

International Awareness

To leaders of state government, business and higher education:

4. Expand the present system of five global education centers and the National Geographic Society's Academic Alliance programs throughout Massachusetts to further:

   - Assist local teachers at all levels in introducing an international focus to curricula;

   - Expand opportunities for a wide variety of foreign-language study in elementary, middle and high schools, as well as international affairs courses in high schools.

5. Establish a mechanism for Massachusetts businesses and the state to fund study-abroad programs in non-Western regions.

To leaders of higher education:

6. Provide more opportunities for high school students to participate in foreign-language and international affairs programs at campus-based summer institutes. Also use the summer institutes to provide teachers at all levels with new internationally focused curricular resources.

7. Consider reinstating language requirements for admission to four-year institutions.

8. Focus on the global economy in liberal arts and in general education to familiarize undergraduate students with the larger international concerns that will have an impact upon their lives and careers.

9. Expand dual-degree programs, particularly for business and engineering students, so they can gain knowledge of a specific world region, learn a foreign language and have opportunities for overseas internships related to their fields of study.

10. Attempt to build a presence on campus of foreign students from all world regions, and encourage their involvement in programs designed to enhance international awareness among native students and local residents.

11. Encourage Massachusetts firms doing business abroad to assist in expanding internship possibilities for students.

12. Initiate continuing education and executive development programs in international business, international affairs and foreign languages, with particular emphasis on international management courses and programs for engineers, managers and other personnel in the high tech industries.

To the New England Board of Higher Education:

13. Undertake a regionwide review to determine which of New England's trading partners or potential trading partners are inadequately served by campus-based area studies and international resource centers, and encourage creation of new centers to fill the gaps.

14. Encourage new and existing area studies and international resource centers to:

   - Establish semester exchange programs throughout New England in international affairs, foreign language, liberal arts and business;
   - Share relevant studies on trade, regulatory, monetary and economic development policy studies with government agencies and legislators as requested throughout New England;
   - Provide seminars and literature for New England business people who want to begin exporting or expand current export operations;
   - Develop relationships with foreign institutions to provide a framework for faculty and student exchange, as well as joint research and curriculum development opportunities.

15. Create and disseminate a comprehensive guide to trade associations and state and non-profit organizations that offer resources to enhance international economic competitiveness in New England.

R&D Investment, Technology Transfer and Technical Assistance

To leaders of state government and business and higher education:

16. Establish a statewide technology transfer council with representatives of business and appropriate university-based research centers to monitor:

   - Current and future needs for research parks;
   - The adequacy of seed money and venture capital;
   - The need for incubators for new companies;
   - Scientific and technological strengths that could be nurtured for economic diversification.

17. Establish a mechanism for businesses and the state to provide funding for expanded seminar programs, allowing exchange between university R&D staff and industrial R&D staff.

To leaders of higher education:

18. State university campuses should use their advanced research, public policy and area studies centers to increase involvement in state-specific policy studies and technical assistance for long-term economic and international trade development in Massachusetts.

19. Massachusetts research universities lacking research, productivity and technology transfer centers should consider establishing them.

20. Create interdisciplinary institutes between schools of business and engineering to develop an integrated approach to competitiveness (Rhode Island College's Center for Industrial Technology as well as MIT's Leader's in Manufacturing Program serve as models for such an initiative).

21. Through graduate schools of business, coordinate efforts with economic development agencies and trade organizations to make more technical assistance available to local businesses. (Boston's Export Strategy Team serves as a model for such an initiative--See Appendix for details).

22. The six Land Grant Universities of New England should devise a coordinated computer database for the region to generate needed demographic and economic data relevant for timely state planning (The California Almanac provides a good model for such an undertaking).

23. The Board of Regents of Higher Education should coordinate the creation of an annual directory of faculty research expertise to include activities of the public and private institutions of higher education in the state. The directory should be disseminated to high technology companies and international businesspeople to utilize as a resource guide.

24. Consider ways to evaluate community and public service provided by faculty as additional criteria for tenure and promotion.

To the New England Board of Higher Education:

25. Assist research universities, technology-based companies and New England state governments in evaluating ways for faculty, post-doctoral students, and industrial engineers and scientists to pursue research sabbaticals in other nations.

26. Engender and coordinate regionwide technology transfer council that would be formed from state level councils to monitor issues and create solutions for commonly shared technology transfer problems for the entire New England region.

APPENDIX

Massachusetts Global Education Centers Programs

All global education centers provide teacher training and curriculum resources to public-school teachers. A discussion of more specific activity at the centers follows.

- Clark University Teachers Center for Global Studies serves Central Massachusetts (28 participating cities and towns):
    - Offers workshops, seminars, forums, a speakers bureau, a summer institute and library resource materials to assist teachers in geography, world history, U.S. history, economics, foreign languages, English, humanities and the sciences
    - More than 250 public school teachers participate annually. More than 1,800 benefit directly, and more than 19,500, indirectly
    - State funding has leveraged contributions from Clark and other private sources
- Framingham State College, Schweitzer International Resource Center for Teachers serves Metro West area outside Boston (16 participating cities and towns):
    - Provides a network of faculty experts who work one-on-one with local teachers to create curriculum packages aimed at meeting needs of specific grade levels
    - Offers workshops on educational competitiveness and international knowledge bringing area business leaders and school superintendents together for discussion
    - One conference on the Pacific Rim attracted 100 teachers
    - Professionals from other nations have participated in various programs at local schools through coordination by the Center
    - State funding has leveraged contributions from other public and private sources
- Tufts University, International Studies Resource Center for Teachers serves Boston, Cambridge and eight surrounding towns:
    - Offers professional development workshops and seminars for local teachers, focusing on Africa, China, Japan, the Middle East and Vietnam
    - Conducts the Geography Workshop with the Massachusetts Geographic Alliance (supported by the National Geographic Society)

  - Through the Fletcher School of Law and Diplomacy at Tufts, sponsors a speakers bureau, which sends foreign students into local classrooms
  - Provides a linkage between public schools and the extensive resource library of the Massachusetts Global Education Project in Winchester
  - Serves more than 400 teachers annually
  - State funding has leveraged substantial contributions from Tufts and other private sources

- UMass-Amherst, International Studies Resource Center for Teachers serves four western Counties (21 participating cities and towns):
  - Spearheaded the formation of the Western Massachusetts Consortium for Global Education, combining the strengths and resources of local international and teacher organizations. The Consortium recently published a major resource directory that catalogs all international teaching resources in western Massachusetts
  - Has linked the Center's global environment resources directly to area schools for use by science teachers through a $5,000 computer system donated by Digital Equipment Corporation
  - Offers a summer institute and a series of eight regional workshops for teachers
  - State funding has leveraged other public and private contributions

- Wellesley College, The Global Education Resource Center for Teachers serves Greater Boston Area (18 participating cities and towns)
  - Offers after-school workshops, seminars, forums, a newsletter, and library
  - Sends international students directly into school classrooms
  - Offers a summer institute that provides professional development in areas studies including Latin America, the Far East, Africa, the Soviet Union and the Middle East
  - More than 1,500 public elementary and secondary-school teachers are served annually
  - State funding has leveraged contributions from Wellesley College and other private sources

WHAT YOU SHOULD KNOW ABOUT THE

B.E.S.T.

Boston's Export Strategy Team

What is BEST?

BEST is a cooperative effort by leading Boston-area graduate business schools to help local companies identify and develop strategies to capture foreign markets for their products or services. By combining university research talent with the expertise and resources of local economic development and trade organizations, BEST offers companies a unique opportunity to understand and pursue their export potential.

Who should participate in BEST?

BEST is specifically designed for Boston-area companies serious about making the most of their export potential.

How will BEST work for you?

Participation in BEST provides your company with three basic services:

1. A Practical Guide for Implementing Your Export Program. A professional market analysis and feasability study, prepared by a graduate student consulting team closely supervised by a business school faculty member in international marketing will provide your company with an export strategy. This will include recommendations on:

- alternative export markets
- marketing objectives
- marketing strategies
- product adjustments
- promotion mix
- distribution channels
- pricing strategies

2.) Speakers on Export Topics. Trade experts will offer practical perspectives on important export topics: on the "nuts and bolts" of exporting as well as current trends. Specific topics will be chosen to reflect your company's particular export concerns. The discussions will center on developing strategic responses to assist you in strengthening your position in international trade.

3.) Ongoing Assistance. Through its public and private sector sponsors, BEST will assist you further in obtaining information and services necessary to implement your export program. Organizations such as the World Trade Institute, Massport's Foreign Trade Unit, the State's Office of International Trade and Investment, and the Small Business Administration will help BEST clients take advantage of their respective trade libraries and data bases. The City of Boston's Economic Development and Industrial Corporation (EDIC), and the Massachusetts Industrial Finance Authority (MIFA) will provide financing assistance to exporters.

Who are the business schools involved in BEST?

The business schools involved are:

- Babson College
- Bentley College
- Boston College
- Bunker Hill Community College
- Northeastern University
- Suffolk University
- University of Massachusetts/Boston

Who are the organizations participating in BEST?

Public and private organizations involved in the program include the:

- City of Boston's Economic Development and Industrial Corporation (EDIC)
- International Coordinating Council (ICC)
- International Business Center
- Massport's Foreign Trade Unit
- Massachusetts Industrial Financing Authority (MIFA)
- State's Office of International Trade and Investment (OITI)
- Small Business Administration (SBA)
- Small Business Association of New England (SBANE)
- World Trade Institute

What does it cost to participate in BEST?

A $200 fee is charged to participate in BEST. It covers the incidental costs students will incur during the semester in preparing the feasibility study (phone calls, transportation, printing, etc.) and the administrative costs of running the overall BEST program.

For further information about BEST, please give one of us a call.

Andrew Bendheim Massport, 439-5560	Paul Horn EDIC/Boston, 725-3342

Charlie van Nederpelt
Boston College, 552-3167

August, 1988

Boston's Export Strategy Team

B.E.S.T.

A Program to Assist Small Businesses in the Exploration of International Marketing Opportunities

A cooperative effort of Boston-area Business Schools and International Trade Organizations

Workforce 2000 Council

Workforce 2000 and its funding mechanism, the Job Development Fund were created by law in June 1988 to improve current and long-term employment and advancement opportunities for residents, while enhancing the competitiveness of Rhode Island businesses through customized job training and retraining, promotion of worksite-based literacy programs, and outreach programs for the unemployed and economically disadvantaged. In just six months, training and upgrading of skills have been provided for over 600 residents of Rhode Island.

Workforce 2000 is funded in two ways. A total of $500,000 has been appropriated from the state's administrative budget to provide for council staff. And one-tenth of one percent of the state's unemployment insurance liability fund has been earmarked for training purposes, accounting for approximately $4 million annually, according to projections. Thus, no new tax funds must be generated.

The Council's executive board includes the presidents of the University of Rhode Island, Rhode Island College, Community College of Rhode Island, business leaders, and state government representatives from the departments of Economic Development, Administration, Human Services, Elderly Affairs, Employment Security, and the Commissioners of Education and Higher Education. Various economic development organizations are also represented.

The Council solicits training proposals on a competitive basis. Eligible applicants include Rhode Island employers, business and trade associations, public and private educational institutions and agencies, non-profit agencies, JTPA agencies, organized labor organizations and state agencies.

The program has purposely been designed to be open-ended and flexible in order to best meet specific training needs for various businesses in the state. Clearly this program serves as a national model for state inititative to improve the quality and availability of the workforce. It has been recognized by the U.S. Department of Labor as such.

Trade Profile for Massachusetts

Massachusetts leads the region in total trade with Canada, which totaled $3.8 billion in 1986. Canada exported to Massachusetts over $2.3 billion and Massachusetts exported to Canada over $1.4 billion in 1986, which translates into a $900-million deficit for the state. Canadian exports comprise 62 percent of the state's total trade with Canada. Figure 5 illustrates the structure of Massachusetts trade with Canada, predominately imports of food and fabricated materials, and exports of finished goods.

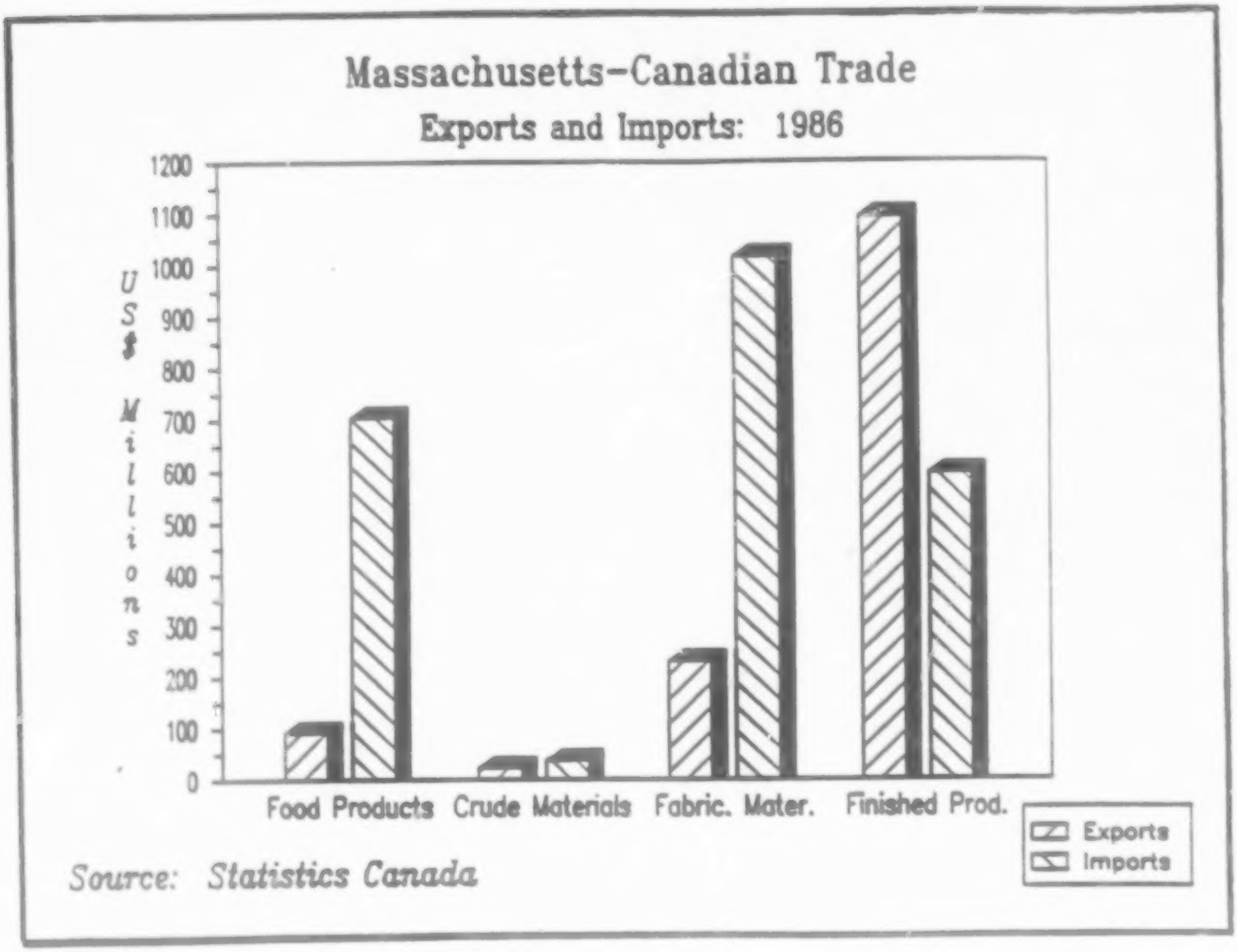
Massachusetts Exports

As seen in Figure 5, Massachusetts predominately exports finished products to Canada. As shown in Table 7, the leading export is computers, with shipments valued at $480 million in 1986. This category amounted to 35 percent of all of Massachusetts' exports to Canada. The computer industry, one of the top employers in Massachusetts, would reap immediate benefit from the FTA because tariffs on computers would be eliminated on January 1, 1989. The FTA does not address trade in computer software, except for expressing a commitment by both parties to establish effective rules for protecting intellectual property rights in the upcoming multilateral trade negotiations of the GATT. Other electronic goods shipped from Massachusetts to Canada in 1986 included telecommunications equipment ($53 million in 1986) and semiconductors ($44 million). Semiconductors currently face up to a 4 percent tariff in Canada while the more manufactured telecommunications equipment can face up to 17.8 percent tariffs.

Other exported finished goods include industrial machinery, electrical lighting and equipment, printed material, photographic goods, medical equipment and supplies, motor vehicles and parts, and apparel.

Fabricated and crude materials, as well as food and agricultural products, make up a smaller part of Massachusetts' exports to Canada. Textiles, such as cloth and yarn, are an important commodity for the state, with exports valued at $46 million in 1986. Bilateral trade in textiles could become complicated

Figure 5



Massachusetts-Canadian Trade

Exports and Imports: 1986

Source: Statistics Canada

Table 7
Leading Massachusetts Exports to Canada
By Major Commodity Category: 1986

Commodity	U.S. $1000s	Percent of total category
Food, Feed, Beverages, Tobacco		
Fish and Fish Products	34.317	37
Vegetables and Vegetable Products	18,286	20
Fruit and Fruit Products	15,122	17
Meat	7,451	8
Food and Food Material	6,563	7
Dairy, Eggs and Honey	2,735	3
Coffee	1,793	2
Cereals and Cereal Products	1,536	2
Live Animals	1,271	1
Feed and Fodder	1,234	1
Sugar and Sugar Preparations	852	1
Total for 11 leading exports	91,160	99
Total for commodity category	91,646	
Crude Materials		
Metal Ore and Scrap	6,893	31
Fur Skins and other Crude Animal Products	3,025	14
Wool and Fine Animal Hair	2,053	9
Crude Wood Materials	1,595	7
Textile Fibers (except Wool)	1,279	6
Rubber, Gums and other Crude Vegetable Products	1,150	5
Abrasives and other Crude Non-metallic Minerals	877	4
Total for seven leading exports	16,872	76
Total for commodity category	22,263	
Fabricated Materials		
Textile Fabricated Materials	45,762	20
Plastic Materials	40,025	17
Valves, Fittings and other Basic Metal Products	31,036	13
Paper and Paperboard	27,904	12
Dyes, Pigments, Paint and other Chemical Products	19,121	8
Metal Bars, Sheets, Pipe and Wire	18,993	6
Organic and Inorganic Chemicals	14,660	6
Abrasives and other Basic Non-metallic Mineral Products	9,125	4
Rubber Fabricated Materials	4,823	2
Lumber	4,377	2
Leather and Leather Fabricated Materials	3,289	1
Total for 11 leading exports	219,115	95
Total for commodity category	230,406	

(Table 7 continued)

Commodity	U.S. $1000s	Percent of total category
Finished Products		
Computers	479,740	44
Aircraft, Engines and Parts	99,896	9
Electrical and other Measuring and Laboratory Equipment	60,197	6
Telecommunication Equipment	52,582	5
Semiconductors and Electronic Tubes	43,705	4
Special Industry Machinery	33,459	3
Electrical Lighting and Equipment	27,033	2
Engines, Generators, Bearings and other General Industrial Machinery	26,296	2
Printing Industry Machinery	25,910	2
Printed Material	25,756	2
Film and Photographic Goods	24,388	2
Medical Equipment	19,326	2
Hand Tools and Equipment	18,621	2
Medical Supplies	16,030	1
Motor Vehicle Parts	15,204	1
Metalworking Machinery	14,678	1
Games, Toys and Sporting Goods	13,405	1
Pulp and Papers Industry Machinery	9,384	1
Household Goods	8,781	1
Apparel and Footwear	8,149	1
Total for 20 leading exports	1,022,540	94
Total for commodity category	1,092,751	

SOURCE: Staff calculations from Statistics Canada, "Domestic Exports/Imports to/from the U.S.A, January to December, 1986."

by a controversial Canadian proposal to establish a duty-remissions program for the apparel industry (see the textiles chapter of this report). Plastics are another top export of this category with $40 million worth in 1986. Other leading fabricated and crude products include valves, fittings, other metal products, paper, chemical products, plus some food products, including fish, vegetables, and fruit.

Massachusetts Imports

By a wide margin, Massachusetts' leading Canadian import is fish -- fresh and frozen whole fish or fillets, processed fish, and fish products. In 1986, the state imported almost $621 million in fish and fish products, as shown in Table 8. The unprocessed fish currently is duty-free; processed fish faces small tariffs which would be eliminated over five years. The FTA could help to stabilize the fish supply and price levels. Other food items Canada exports to Massachusetts include meat, vegetables, plus whiskey and other beverages.

Massachusetts imports great quantities of newsprint and other paper goods, with shipments valued at $211 million in 1986. The U.S. paper industry is very price competitive in the world paper market, undercut only by Canada. The FTA would preserve the duty-free status of newsprint but would not address some of the other non-tariff barriers that help the Canadian paper industry maintain a competitive edge. The Canadian paper industry benefits not only from an abundant supply of lumber but also enjoys government subsidies to help replace some of its older equipment. For example, in 1987 the Canadian government built a highly advanced and efficient paper mill.

Massachusetts also imports a large amount of lumber from Canada, primarily softwood, with $196 million in shipments in 1986. Lumber currently is shipped duty-free to the United States. However, a countervailing duty case brought by U.S. softwood producers, charging that the Canadian government subsidizes its industry, has resulted in Canada charging its own producers a 15 percent export tax on softwood shipped to the United States.

Like Maine, Massachusetts depends heavily on Canada for energy resources. In 1986, Massachusetts imported $191 million worth of petroleum and coal as well as $91 million worth of electricity. Canadian electricity is cheaper than U.S. electricity for several reasons, as explained in the energy section of this report.

Table 8
Leading Massachusetts Imports from Canada By Major Commodity Category: 1986

Commodity	U.S. $1000s	Percent of total category
Food, Feed, Beverages, Tobacco		
Fish and Fish Products	620,776	88
Meat	28,509	4
Whiskey and other Beverages	13,942	2
Vegetables and Vegetable Products	12,515	2
Sugar and Sugar Preparations	10,303	1
Cereal and Cereal Products	9,046	1
Feed and Fodder	1,697	0
Total for seven leading exports	696,787	99
Total for commodity category	705,006	
Crude Materials		
Precious Metals	15,086	40
Seeds, Oil, Kernels and other Crude Vegetable Products	9,854	26
Pulpwood and Crude Wood Products	4,038	11
Asbestos and other Crude Non-metallic Minerals	3,207	9
Rawhides, Skin and other Crude Animal Products	1,498	4
Textile and Related Fibers	1,205	3
Non-precious Metals, Ore and Scrap	857	2
Total for seven leading exports	35,745	96
Total for commodity category	37,263	
Fabricated Materials		
Newsprint and other Paper	211,208	21
Lumber	195,580	19
Pertoleum and Coal Products	191,055	19
Electricity	91,466	9
Abrasives and other Non-metallic Basic Mineral Products	76,544	8
Non-precious Metals and Basic Metal Products	76,514	8
Precious Metals	43,653	4
Shingles, Plywood and other Wood Fabricated Products	42,343	4
Wood Pulp	35,306	3
Rubber and Plastic Materials	21,549	2
Organic and Inorganic Chemicals	14,718	1
Textile Fabricated Materials	4,234	0
Leather and Leather Products	2,688	0
Total for 13 leading exports	1,006,859	99
Total for commodity category	1,017,355	

(Table 8 continued)

Commodity	U.S. $1000s	Percent of total category
Finished Products		
Office Machines	167,566	28
Motor Vehicle Parts	126,537	21
Aircraft, Engines and Parts	43,039	7
Telecommunication Equipment	39,617	7
Hand Tools and Equipment	36,557	6
Special Industry Machinery	26,051	4
Motor Vehicles	24,437	4
Apparel and Footwear	13,944	2
Containers and Closures	13,304	2
Printed Material	12,892	2
Prefabricated Buildings and Structures	11,996	2
Engines, Generators and other General Purpose Industrial Machinery	9,513	2
Measuring Equipment	7,888	1
Electrical Lighting and Equipment	7,652	1
Photographic Goods	7,597	1
Medical Supplies	6,149	1
Heating and Refrigeration	5,906	1
Total for leading 17 exports	560,645	94
Total for commodity category	594,845	

SOURCE: Staff calculations from Statistics Canada, "Domestic Exports/Imports to/from the U.S.A, January to December, 1986."

Other leading Massachusetts imports of crude and fabricated products include mineral products, basic metal products, precious metals, plywood, wood pulp, and plastics. Massachusetts also imports a wide variety of finished products from Canada. Office machines lead this category, with imports valued at $168 million in 1986. Massachusetts led the region in imports of automotive products from Canada, with imports amounting to $151 million, 86 percent of which was auto parts. Telecommunications equipment is another leading finished good, with $40 million in imports in 1986. Other leading finished-goods imports from Canada include aircraft and parts, tools and equipment, special industry machinery, apparel and footwear, containers, printed materials, prefabricated buildings, and general-purpose industrial machinery, such as bearings, motors, pumps, and generators.

Summary

Massachusetts, as a highly industrial state, could see real benefit through the approval of the FTA. The computer industry, already the state's leading exporter, would certainly gain by the immediate removal of Canada's tariff on this equipment. Other electronics industries would also benefit. Removal of steep tariffs would help telecommunications equipment manufacturers, but this industry would still face other discriminatory measures, not addressed by the FTA. The computer software industry, which is very important to the Massachusetts economy, would not necessarily receive immediate benefit from the FTA, however, further discussions are planned for issues of intellectual property rights.

The industrial machinery manufacturers could also expand their Canadian market, another step toward this troubled industry's recovery. Textile producers, another leading industry in Massachusetts, would also benefit through the removal of steep tariffs. If, however, Canada goes through with their proposed duty-remissions scheme, U.S. firms would face a new barrier to competition.

The FTA would also help to stabilize Massachusetts' supply of electricity from Canada. A stable energy supply is important to existing industries and can also help attract new-energy intensive industries.

END

U.S. Dept. of Education

Office of Education
Research and
Improvement (OERI)

ERIC

Date Filmed

March 29, 1991